NOV 1 5 1932

ELECTRICAL WORLD

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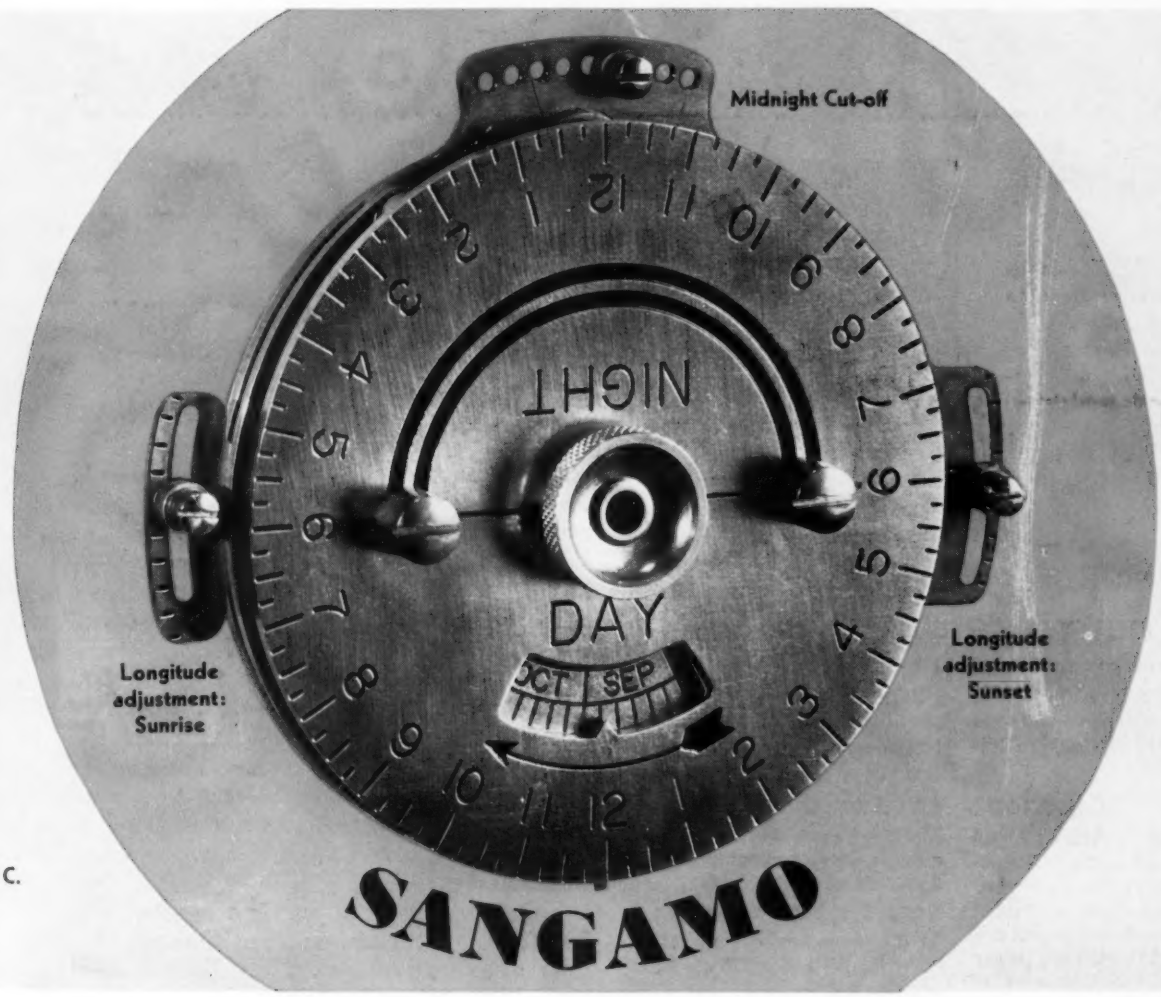
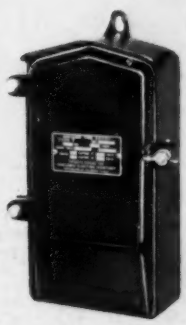
TYPE VS
onous motor
-60 cycles.

TYPE VW
y-wound A. C.



TYPE TC
Electrically-wound A. and D. C. 11-jewel Hamilton escapement



TYPE VS-VW
Weatherproof for outdoor installations.

TIME-SWITCHES

with or without

ASTRONOMICAL DIAL

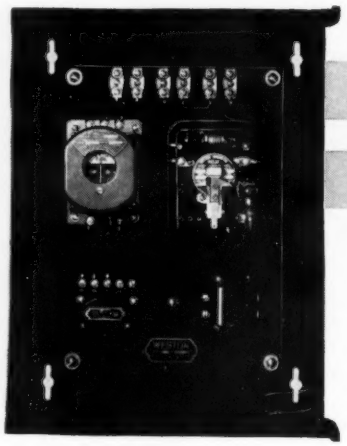
THE NEW SANGAMO ASTRONOMICAL DIAL operates switches within plus or minus five minutes of true sunset and sunrise time. It is made for five latitudes and with longitude adjustments. The construction throughout is characterized by Sangamo's precision engineering and fine workmanship.

Sangamo Time-Switches . . . a full line of American-made time-switches designed for every type of service. Electrically-wound and synchronous motor types . . . a. c. or d. c. operation . . . indoor and outdoor . . . duplex for two-circuit control . . . with every control arrangement for single-pole single-throw, to triple-pole double-throw. And now . . . with astronomical dial.

NGAMO ELECTRIC COMPANY • SPRINGFIELD, ILLINOIS

LIGHT COLLECTOR—contains Weston PHOTRONIC★ photoelectric cells. Mounts out-of-doors facing North sky. May be located remote from Relay Cabinet

PHOTRONIC★ *Automatic Illumination Control*



RELAY CABINET—located where convenient to simplify installation. Only external connections need be made—to Light Collector, power source and circuit-to-be-controlled. Ordinary leads for all connections

RELIABLE • EASY TO INSTALL
TROUBLE-FREE • ECONOMICAL

No longer is illumination control by light sensitive cells a laboratory experiment. The Weston PHOTRONIC★ Illumination Control Relay is practical—an advanced type of photoelectric control that gives reliable, positive, trouble-free operation . . . that can be profitably applied to outdoor lighting.

Weston PHOTRONIC★ Illumination Control Relays are being used today . . . controlling airport beacons, light houses, street lights, flood lights, and large signs—automatically turning lights on and off in accordance with pre-determined levels of daylight intensity.

The performance records of these installations are outstanding. They definitely prove that Weston PHOTRONIC★ Illumination Control Relays are reliable, free from maintenance and continual adjustment and replacement.

Shipped complete, ready to put to work—Weston PHOTRONIC★ Illumination Control Relays are simple and easy to install. They directly control circuits up to 3,000 watts at 110 volts . . . can be made to operate on any commercial frequency A. C. and down to 6 volts D. C.

Made possible by the famous Weston PHOTRONIC★ photoelectric cell, Weston PHOTRONIC★ Illumination Control Relays mark the beginning of a new era . . . automatic illumination control direct by daylight intensity.

OUTSTANDING FEATURES

NO REPLACEMENTS—PHOTRONIC★ photoelectric cells have unlimited life. No amplifiers. Maintenance minimized.

UNAFFECTED BY LINE VOLTAGE VARIATIONS—PHOTRONIC★ photoelectric cells require no filament or plate voltage. Their high current output directly operates sensitive relays. No auxiliary power needed.

ADJUSTABLE AT INSTALLATION—Relay may be set by zero-adjuster to operate at any illumination from 2 to 20 Foot-Candles . . . the only field adjustment necessary.

CELL REMOTE FROM RELAYS—distance does not affect operation. Permits flexibility, ease and low cost of installation.

EASY TO INSTALL—completely wired at factory. Simply mount units and make external connections.

CONTROLS 3,000 watts at 110 volts — operates on all commercial frequencies A. C. and down to 6 volts D.C.

LIGHTNING FLASHES and quickly passing shadows do not actuate relay.

LOW INITIAL COST—and practically free from all maintenance.

Descriptive literature gladly sent on request.

WESTON

★**PHOTRONIC**—a copywrited name used to designate the advanced type photoelectric cells and devices manufactured exclusively by the Weston Electrical Instrument Corporation.

ELECTRICAL INSTRUMENT CORPORATION

578 FRELINGHUYSEN AVENUE . . . . . NEWARK, N. J.

ELECTRICAL WORLD

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for the Week Ending

November 12, 1932

Insull in Hospital; Extradition Ruled Legal

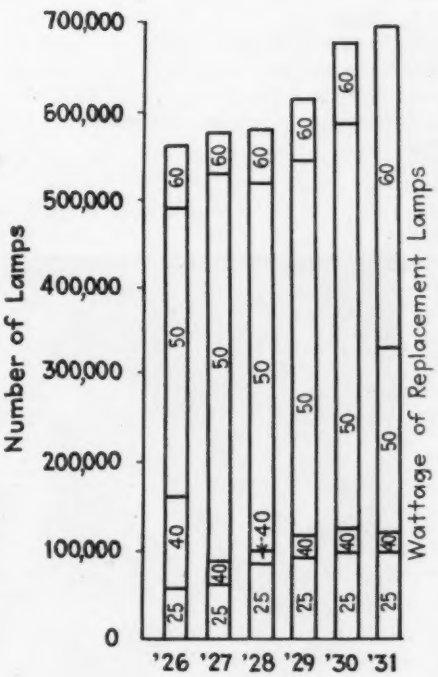
Each successive day appears to bring Samuel Insull one step nearer to extradition from his haven of refuge in Greece. Two Cook County assistant district attorneys (ELECTRICAL WORLD, November 5, page 609) have sailed for Greece. The Greco-American extradition treaty has been ratified. Samuel Insull has been arrested by the police upon request of the U. S. Department of State. The Court of Appeals in Athens has found the recently ratified extradition treaty to be retroactive and has declared Mr. Insull's arrest to be justified.

Committed to the Aretaieon Hospital in Athens, where he was transferred after the Court of Appeals dismissed his plea for release, the Chicago utility man was examined by two judicial physicians who reported: "Samuel Insull has a hypertrophic heart, with the left quarter overwidened. He is also diabetic. He has an expansion of the liver. Long ago he suffered an encephalic congestion (in the brain), whose traces still are apparent.

"He is, of course, submitted to a certain diet," the report continued. "However, the above diseases, especially of the heart, lead to the conclusion that the patient needs continual medical supervision to avoid danger to his life."

"I look healthier," Mr. Insull remarked, "but I really need to take care of myself."

Judge Walter C. Lindley has refused to grant a petition which would have thrown the billion-dollar Middle West Utilities Company, now in receivership, into bankruptcy. The court held that the organization, one of the largest of the Insull empire, has been making satisfactory progress in receivership and that to allow the bankruptcy petition would endanger that progress.



Lamp Wattages Rise in Utility Replacements

In the middle of 1931 the Hartford Electric Light Company announced to its customers that from then forward it would replace all 50-watt lamps by the 60-watt size on the customary free renewal basis. Popular acceptance of the larger rating was immediate, with only a small percentage of objectors, who were provided with lamps of lower wattage on request. The accompanying chart shows the rapidity of 60-watt lamp acceptance on the system and the trend toward the use of larger sizes in the past six years. In 1931 the company distributed 366,683 60-watt lamps. The average wattage of lamps renewed from 1926 to 1931 inclusive was, by years: 52.3, 56.68, 58, 58.88, 60.8 and 64.1.

Los Angeles Dispute Off; to Use Hoover Dam Power

Settlement of the long-standing dispute between Southern California Edison and the Los Angeles Bureau of Power and Light was reached last week with the signing of an agreement by Mayor Porter under which the city will abandon its plan to build a steam-generating plant at the harbor (ELECTRICAL WORLD, August 27, page 258), the cost of power purchased from the Edison company will be gradually reduced and the co-operation of city and utility will bring Hoover Dam power to Los Angeles (ELECTRICAL WORLD, September 24, page 390).

The contract is a modification of a twenty-year purchasing contract whereby the bureau buys energy from the company. Beginning next January the cost of power bought by the bureau will be reduced 6 per cent, and 15 per cent the next year. Upon introduction of Hoover Dam power the bureau will use for stand-by purposes steam plant units of the company at Long Beach. Emergency service will be rendered between the city and utility and for mutual benefit each will generate or transmit Hoover Dam power.

The dispute-settling contract, as a resolution adopted by the Water and Power Commission and as an ordinance adopted by the City Council, was ratified November 3 by the Edison company board of directors and will be submitted to the California Railroad Commission for approval.

Harry J. Bauer, chairman Southern California Edison Company, Ltd., in discussing the new agreement stated:

"This agreement is a common-sense, business-like settlement in the community interest of a community problem. Duplication of investment in the field of electrical service is and always has been uneconomical. The added expense

caused by duplication necessarily must be reflected in the cost of service to the consumer."

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Inducement Wage for Labor to Aid Market Development

Behind the bare facts that the union electricians of Cleveland have agreed upon three scales of wages—one for new jobs, another for modernization and a third for maintenance (ELECTRICAL WORLD, October 15, page 519)—is a radically new concept on the part of organized labor to introduce not only a promotional rate into the wage situation but to farsightedly bring the employing contractor to the point where it is to his advantage to exert definite effort to hire a salesman who will go out on behalf of the mutual interest of employer and worker and stir up more business for both. Also there is the desire to preserve investment values in homes and other real estate by intelligently modernizing old structures which economically deserve it. Started in Cleveland, the plan is said to be under contemplation for other cities, specifically Detroit and Milwaukee and possibly New York.

Labor pays for market development

According to Clair Killen, who is sponsoring the move, "What we are really doing in this form of labor-employer relations is to drop our scale in order to encourage electrical development. We are paying for market development." Mr. Killen sees "the contractor taking on the function of management to serve the electrical needs of the community, for he has a place in the industry only so long as he functions in a socially and economically sound manner."

Here are a few high points in the Cleveland agreement: The employer, in order to qualify to employ members of the local union, agrees to employ not less than one salesman who shall have a knowledge of the work and whose sole duty shall be to solicit and secure work specified. The employer shall keep a daily record of the salesman's activities and accomplishments. Work done shall be strictly in accordance with city ordinances and penalties are provided for violations. All faulty work shall be remedied by the union at its own expense.

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City Plant Proposed for Cincinnati

A step was taken last week by the Cincinnati Council Committee on Public Utilities toward municipal ownership of an electrical generating system that will light certain streets and viaducts where the equipment is owned by the city. The committee recommended for passage an ordinance authorizing the City Manager to contract with Fosdick & Hilmer, consulting engineers, who are to study the equipment of the City Department of Water and prepare plans and specifications and an estimate of the cost for the use of such part of the equipment as is adaptable, and for such new additional equipment as may be required to generate electric power and light for pumping purposes and for street lighting on streets where the city owns the equipment and for city departments. The cost of the survey will be $8,000.

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Grain Grinders on the Farm May Displace Central Miller

After three years of study and research, engineers of the Ontario Hydro-Electric Power Commission announce the perfection of an electrical grain grinder which in design, efficiency, low cost of operation and durability is said to mark a distinct advance in the grinding of grain and to do away with the necessity of having to haul grain to the custom mill, with the incidental loss of time and added cost.

The invention involves a grinding plate of the toothed variety, manufactured from a very hard alloy steel. A pair of these plates is fitted in a machine with a direct drive from an inclosed 1½-hp. motor and is capable of grinding grain for feed at an amazingly low cost, in many instances less than 1 cent per hundredweight. To protect the machine from damage from foreign materials a magnetic protective device has been developed. The grain is passed through a small hopper in which permanent magnets have been placed. These are an integral part of the machine.

In order that the motor may be used for other purposes than grinding grain the machines are equipped with a lever which disengages the plates and allows the motor to run freely. This gives the farmer a combined electric utility motor and grain grinder that may be used for driving other farm equipment.

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Calking-Welds in Water Tunnels

Lincoln Electric Company

Though not using complete welded assembly for the steel liner in the 21-mile water tunnel from Hillview reservoir in Yonkers to Brooklyn, New York City engineers specified calking by welding after the sections had been assembled in this tunnel. Each ring required 102 ft. of continuous welding where two angles butt together. Operators averaged 31 lineal feet of welding per man per hour. Specifications called for special steel liner construction with arc-welded calked joints near and under the East River where seepage might be encountered. The liner is made up of 1-in. plate fabricated in sections above the ground. Three sections form a 20-ft. circle. A total of 13,920 ft. of ⅜-in. fillet welds were laid above ground along 4 x 4 x ½-in. angles which were riveted to the liner segments.

Roosevelt's Election Emphasizes Power Question

Among the inevitable uncertainties of an election in which a new candidate is chosen for an important office is that of his probable stand and action on certain questions. While Franklin D. Roosevelt has for years expressed opposition to power companies and their policies in his office as Governor of New York State and has in one pre-election speech (ELECTRICAL WORLD, October 1, page 418) made clear his stand as of that date, his endeavor to become more conservative has been cumulatively more evident. Mr. Roosevelt's election as our next President nevertheless will tend to emphasize the political element in power questions, regulation and national policies.

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N.E.L.A. National Sales Section Reports Progress and Plans for More

NO ONE put it forward as a slogan, but "Sell the Seller" can be taken as the common attitude of practically all the committees of the National Sales Section, N.E.L.A., at their meeting in Chicago last week. The job of the commercial men is to sell the electric utilities themselves on the proposition that ranges, water heaters, air conditioning, wiring adequacy, the electric home and group appliance sales are good business. Also, as stated by G. E. Whitwell, Philadelphia Electric Company, at the joint meeting of all committees, more now than in the past real thought must be given to the relationship between the utility and the electrical contractor and dealer. These two things, the need for wholehearted acceptance of commercial programs by utility executives and the need for amicable and co-operative trade relationship, stood out prominently as the most important occupations of the series of committee meetings.

Out of the meeting of the National Electric Cookery Council came the news that the national organization of the electric range-selling campaign is taking shape. The first local council has already been formed in Milwaukee and others are coming into being. In some parts of the country organization progress is being hindered by the availability of very low cost natural gas and to some extent by the apathy of local utilities. But in spite of these hindrances the campaign is gathering momentum and confidence that it will attain its objective is not impaired. That range prices must be maintained was stated by Pierre Miles, Edison General Electric Appliance Company, as a necessity, since not otherwise can the manufacturers continue and enlarge their advertising and selling appropriations. The electric refrigerator continues as the star performer in the sales field. Despite existing conditions in 1932, 86 per cent of the period's quota was sold in the first six months and 78 per cent of quota in the first nine months. The sales tax that went into effect early in the summer greatly affected refrigerator sales, reducing them to low levels in July and August, but a pick-up of 30 per cent over August was achieved in September. Unofficial assurances from refrigerator manufacturers give confidence that the work of the refrigeration bureau will be continued in 1933.

Surface wiring welcomed

Surface wiring as a means for increasing the number of outlets in homes was discussed by the home-wiring committee and a motion was carried to offer to the section executive committee the suggestion that such surface wiring methods as have been or may be approved by the National Electrical Safety Code be promoted by the electric utilities and that effort be made to enlist the assistance and co-operation of electrical contractors in that promotion. In the field of power sales no one has yet come forward with a formula for overcoming the growing competition of the isolated plant. Improvements in performance and lowered costs of Diesel engines are a challenge to the electric utilities. Also the progress in small steam turbine design plus present availability at low cost of much second-hand steam equipment add to the difficulty of the situation.

Keynotes and keynoters were conspicuously absent from these meetings of the Sales Section. In every committee meeting there was recognition of the obstacles in the way of the particular activity. Yet there was apparent no pessimism. Rather there was an optimism firmly grounded in the confidence that hard work and intelligent direction could and would overcome even greater difficulties.

▼

High Voltages Generated With Sand in Air Blast

Blowing sand through channels in copper tubing represents the latest way of generating high voltage. Experiments are reported in the *Physical Review* by Richard E. Vollrath of the University of Southern California, who gives credit to Prof. R. A. Millikan for the use of facilities at the California Institute of Technology. The whole apparatus has not much more than 2 ft. of tube length and a 2-ft. diameter sphere to constitute the charged object. A small amount of sand propelled by 30 lb. of compressed air generates 250,000 volts with ease. It is felt certain that the very high voltages required for destructive assault on the atom can be derived from larger apparatus built on the same pattern.

Snowstorms and sandstorms have long been known to create corona-forming voltages on low-voltage or otherwise unenergized conductors in the open. Dust explosions have been attributed to sparks originating in charges arising out of the friction of the particles with the air or other objects. A fraction of an ounce of flour blown into a large room has been known to create a dust cloud which registered a 200-volt potential on a radium-coated collector.

Giving the copper tubes a slight bend promotes the collisions and the turbulence of the sand and raises the voltage. Higher speeds of sand with higher air pressures are also expected to raise the general efficacy of the equipment as a voltage generator.

Pre-Election Tension Blankets Trade

That creeping paralysis which has been edging up on America as each succeeding week of the Presidential campaign drifted by into oblivion reached its high point this week. While trading on Monday on the security markets closed with notable strength, neither bulls nor bears were willing to take a market-wise position until post-election psychology had been demonstrated. There was one well-known organization which advised its clients in effect that not, in all probability, for many years to come would there be an opportunity to buy securities at such favorable prices as prevailed before this election. There were others who saw the bottom dropping clear out of everything until the shock was over. Not that Wall Street doubted who would be elected; only that it could not make up its mind as to what it would mean.

Carloadings for the second consecutive week fell off, this time by 24,521 cars. Energy production holds up well. Commodity prices continue notably weak.

Rehabilitation committee reports some $70,000,000 of agreed-upon expeditures as the result of its work to date. Railroad earnings are at the rate of about 1 per cent on their investment.

Whatever else may eventuate, it is a fairly safe guess that soon indeed will the public attitude show a change. Too long has the lively American spirit suppressed itself for the uncertaintie of life. It is due to have another spell of desperate despair or hilarious hope before many days pass.

Coming Meetings

National Association of Railroad and Utilities Commissioners—Hot Springs, Ark., Nov. 15-18. James B. Walker, 270 Madison Ave., New York.

American Society of Mechanical Engineers—Annual meeting, New York, Dec. 5-9. C. W. Rice, 29 West 39th Street, New York.

American Association for the Advancement of Science—Annual convention, Atlantic City, N. J. Dec. 27-31. C. F. Roos, Smithsonian Institute, Washington, D. C.

American Physical Society—Annual meeting, Atlantic City, Dec. 28-30. W. L. Severinghaus, Columbia University, New York.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 23-27. H. H. Henline, 33 West 39th Street, New York.

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Niagara River Rights Disputed Before Commission

Conflicting applications by the Niagara Falls Power Company and the city of Lockport, N. Y., for the use of 275 cu.ft. per second of water to be diverted from the Niagara River for power development were presented to the Federal Power Commission at a hearing last week. On behalf of the company, which holds a license for the 20,000 c.f.s. of the remaining water, and has been using this additional amount under a temporary permit which has expired, its counsel, Randall J. Le Boeuf, asked for an extension of another twelve months. He contended that the city of Lockport is without legal authority to apply for or receive a license for the utilization of water of the river for power purposes between New York State Barge Canal and Eighteen-Mile Creek (ELECTRICAL WORLD, September 17, page 355).

M. K. Doty, counsel for the city of Lockport, asserted that the water can be utilized at much greater advantage at Lockport than at Niagara. The commission has taken the dispute under consideration.

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Electric Shovel Improves Coal-Stripping Operations

In a new type of electric shovel used in stripping operations at the Jay Hawk mine of the Clemens Coal Mining Company of Pittsburg, Kan., adoption of a counterweight on the hoist motion is said to reduce the peak demands on the utility lines and to enable the same equipment to handle increased output. The shovel is completely electrified with the General Electric Company's Ward Leonard equipment. Approximately 3,000 hp. is involved.

The shovel, with an 18-cu.yd. dipper, can go through a cycle of operations in 45 seconds; in less than a minute it can scoop out 27 tons of earth, hoist high enough to clear the bank, swing around to the dumping point, dump, swing back, and lower to the digging point in readiness for another cycle. It could fill an ordinary two-car garage or a gondola car in three minutes.

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Pacific Northwest Inquiry by Oregon Commission Closed

Testimony by Franklin T. Griffith, president, and W. H. Lines, vice-president, brought to a close the long-drawn-out hearing on the affairs of the Pacific Northwest Public Service Company, Portland, Ore., and its parents and subsidiaries, before the Oregon Public Utilities Commissioner (ELECTRICAL WORLD, October 8, 1932, page 485). The final sessions were devoted primarily to an investigation of the methods employed by the Albert E. Peirce & Company stock-selling organization to secure the transfer of Pacific Northwest Company's preferred issues into the $4 preferred issue of Central Public Service Corporation during the years 1930-31.

The extent to which the stock sale was participated in by employees of the Pacific Northwest Company's subsidiaries was brought out by the testimony of various district managers of the company and department heads. Practically all of these witnesses testified to resisting efforts of the stock-selling agency to turn their operating organizations into stock salesmen during hours when the men were supposed to be busy on their operating jobs.

The corporate structures and interrelationship of the various companies in the Central Public Service group were gone into at length by the commissioner's investigator, presumably with intent to show that the credit of the Pacific Northwest Public Service Company had been wrongly used to supply funds for doubtful purchases of and loans to other companies. Mr. Griffith dwelt on the hope that may be entertained by Central Public Service stockholders in the success of the reorganization planned for them through transfer of their $4 cumulative preferred stock into non-cumulative participating preferred stock of the Central Public Utility Corporation.

After the hearing Commissioner C. M. Thomas announced that he would ask the next Oregon Legislature to extend the jurisdiction of his department to include regulation of security issues of companies operating in the state. In the meantime, at his request the Federal Power Commission assumed jurisdiction over security issues of the Portland General Electric Company, which is the only federal licensee in the Portland group (ELECTRICAL WORLD, November 5, 1932, page 614).

Detroit Seeks Rate Cut of $2,000,000 Now

Contending that testimony taken by the Michigan Utilities Commission in the course of the rate dispute between the city of Detroit and the Detroit Edison Company (ELECTRICAL WORLD, September, 17, page 357), coupled with the drastic downward trends of labor, material and other costs, justifies a temporary reduction of $2,000,000 a year, affecting all classes of customers, pending a determination of permanent rates, a brief has been filed with the commission on behalf of the city.

Denunciation of past practices of the commission was made in pointing out that at the hearing before the commission President Alex Dow testified that, according to the brief, "he has been the dictator in fixing rate schedules for the past 30 years; that he has never fixed such rates upon any of the legal methods laid down for rate-making purposes, but that he has fixed such rates, to use his own language on the witness stand on a 'by guess and by God method.'

"Further, the testimony shows that when Mr. Dow has fixed such rates that the commission has merely rubber stamped them with its approval and that in not one single instance during the past 30 years' time has this commission, or any of its predecesors, ever altered such Dow rate schedules even to the extent of crossing an additional 't.'"

The city pleads "that the commission order an independent investigation by forthwith ordering an inventory, audit and appraisal of the Detroit Edison Company, and that the commission order, pending the conclusion of such inventory, a temporary rate cut in all classes of rate charges in the amount of at least $2,000,000 per annum."

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Utility Revenues Increase with September Output Rise

Pronounced gains are indicated in revenue of electric light and power companies for September, according to returns thus far received by the ELECTRICAL WORLD. Compared with 1931 the average is down but 6.6 per cent, against 9.3 per cent in August, 8.9 in July and 8.0 per cent in June.

As stated in the issue of October 29, such a turn was to be anticipated in view of the increased output. Based on the $171,930,000 a year ago, fuller returns than are now available ought to show a total September revenue for the industry close to $160,000,000. The greatest improvement occurred in the East, but favorable changes are indicated also in the agricultural Northwest and in the Far West.

Energy output of all public utility

plants in September, as announced by the U. S. Geological Survey, also improved. Amounting to 6,738,948,000 kw.-hr., it was down 11 per cent from 1931, against 12 per cent in August and 16 per cent in July. Average daily production increased 3.5 per cent from August, whereas the normal change is only 2 per cent. Water power contributed 36 per cent of the total and exceeded last year's by 11 per cent.

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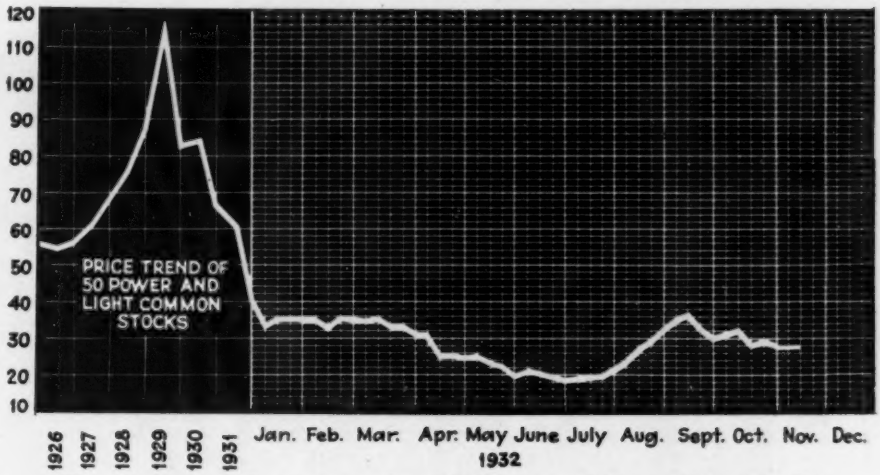
Write-Ups, High Yields Told at C. G. & E. Hearings

Continuing the by-now-thoroughly-familiar tenor of their appointed way, Federal Trade Commission examiners and witnesses at the hearings of the Columbia Gas & Electric Corporation last week told once more the story of both write-ups and high investment returns. Melvin S. Anderson, examiner, reported that the return to the corporation on its average invested capital in the years 1925 to 1930 ranged from 1.76 per cent in the former year to 33.69 per cent in 1929. In 1930, testified Mr. Anderson, the return was 20.65 per cent.

Utility Stocks Show Little Change



Electric light and power stocks and the general list weakened badly as the election news came out, but the "Electrical World" index held at 28.7, as compared with 28.3 the preceding week.

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That an "excess" value of $6,214,520 was recorded in connection with the acquisition in 1928 of the Union Gas & Electric Company by the Cincinnati Gas & Electric Company, a subsidiary of Columbia, was brought out by the examiner. Mr. Anderson stated that the Cincinnati company recorded the value of the property following the acquisition at $20,468,730, while the ledger value of the books of the Union company at that time was $14,254,210.

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Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Alabama Power Co. (Year ended August 31)					
Gross earnings	$16,265,377	$17,938,153	— 9.3	48	47
Net earnings	8,427,049	9,417,313	—10.3	..	..
Net balance	1,501,486	2,873,593	—47.2	..	..
Duquesne Light Co. (Year ended September 30)					
Gross earnings	25,985,460	28,337,836	— 8.3	43	42
Net earnings	14,868,665	16,384,782	— 9.3	..	..
Net balance	11,122,223	13,434,134	—17.2	..	..
Georgia Power Co. (Year ended August 31)					
Gross earnings	23,319,541	25,576,736	— 8.8	50	45
Net earnings	11,653,560	11,609,790	+ 0.4	..	..
Net balance	2,599,041	3,071,601	—15.4	..	..
Kansas City Power & Light Co. (Year ended September 30)					
Gross earnings	14,774,216	14,848,714	— 0.5	57	58
Net earnings	6,405,785	6,221,403	+ 3.0	..	..
Net balance	4,280,845	4,437,564	— 3.5	..	..
New Orleans Public Service, Inc. (Year ended August 31)					
Gross earnings	16,037,160	17,727,784	— 9.6	81	75
Net earnings	4,044,994	4,388,514	— 7.8	..	..
Net balance	519,875	771,255	—32.5	..	..
Northern States Power Co. (Year ended August 31)					
Gross earnings	33,129,663	33,888,774	— 2.2	58	57
Net earnings	13,792,734	14,441,360	— 4.5	..	..
Net balance	2,922,484	3,857,888	—24.2	..	..
Pennsylvania Power & Light Co. (Year ended August 31)					
Gross earnings	34,161,823	35,305,136	— 3.5	53	54
Net earnings	16,028,924	16,144,935	— 0.7	..	..
Net balance	6,537,744	6,744,671	— 3.1	..	..
Philadelphia Electric Co. (Nine months ended September 30)					
Gross earnings	47,169,667	49,130,124	— 4.0	52	54
Net earnings	22,633,865	22,639,963	— 0.03	..	..
Net balance	14,497,238	14,612,463	— 0.80	..	..
Puget Sound Power & Light (Year ended September 30)					
Gross earnings	14,061,764	16,204,738	—13.2	61	63
Net earnings	5,519,642	6,049,552	— 8.8	..	..
Net balance	591,445	737,438	—19.8	..	..
Southern California Edison* (Year ended September 30)					
Gross earnings	$38,043,604	$41,018,463	— 7.2	31	33
Net earnings	26,205,192	27,615,978	— 5.1	..	..
Net balance	19,198,384	20,689,811	— 7.2	..	..
Virginia Electric & Power (Year ended September 30)					
Gross earnings	15,868,724	17,097,062	— 7.2	65	66
Net earnings	5,521,985	5,815,636	— 5.0	..	..
Net balance	2,464,068	2,890,659	—14.8	..	..

Holding Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
American Light & Traction and subsidiaries (Year ended September 30)					
Gross earnings	$39,440,495	$44,313,387	—11.0	73	73
Income from subsidiaries	6,859,191	8,840,995	—22.4	..	..
Net balance	6,724,754	8,161,980	—17.6	..	..
American Power & Light and subsidiaries (Year ended August 31)					
Gross earnings	79,621,028	87,970,019	— 9.5	53	54
Income from subsidiaries	13,802,537	18,308,820	—24.5	..	..
Net balance	2,158,128	7,121,174	—69.8	..	..
American Water Works & Electric and subsidiaries (Year ended September 30)					
Gross earnings	45,470,452	51,293,833	—11.4	56	58
Net balance	3,499,134	4,700,482	—25.5	..	..
Associated Gas & Electric and subsidiaries (Year ended September 30)					
Gross earnings	100,006,852	105,864,720	— 5.5	66	61
Commonwealth & Southern and subsidiaries (Year ended September 30)					
Gross earnings	118,504,378	133,120,541	—11.0	53	54
Net balance	7,177,935	15,168,450	—52.7	..	..
Engineers Public Service and constituent cos. (Year ended August 31)					
Gross earnings	48,387,527	53,297,002	— 9.2	65	66
Net balance	2,633,167	3,998,011	—34.0	..	..

*Operating companies do not include deductions for depreciation.

Gross earnings — (Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings — Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Income from subsidiaries — Balance available from income of subsidiaries for holding company. Net balance — Balance available from income for common stock dividends.

Weekly Output Turns Downward

Central-station energy output for the week ended November 5 was 1,525,410,000 kw.-hr., or 6.3 per cent less than in the corresponding week of 1931, according to the National Electric Light Association. While this constitutes a decrease compared with the two preceding weeks, it also brings the closest approach to last year's operations since February. The record shows a sharp decline at the corresponding time in each of the past three years, whereas the present decrease is small.

Output in the Atlantic seaboard region made a nearer approach to that of 1931 than in the week before, although for New England alone the showing is not so good. The Central industrial area took a further step toward closing the former wide gap between 1931 and 1932 production.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1932	1931	1930	1929
November 5	1,525	1,628	1,728	1,798
October 29	1,533	1,652	1,741	1,816
October 22	1,528	1,647	1,747	1,824
October 15	1,508	1,656	1,729	1,799
October 8	1,506	1,653	1,724	1,806

Per Cent Change from 1931

Region	Week Ended Nov. 5	Oct. 29	Oct. 22
Atlantic Seaboard	—2.6	—3.1	—1.2
New England alone	—3.5	—2.7	+0.6
Central industrial	—7.8	—9.2	—9.3
Pacific Coast	—9.1	—7.8	—9.8
United States	—6.3	—7.2	—7.2

▼

World Trade Parley Opens With Solemn Warning

Twenty experts, forming the preparatory committee of the World Monetary and Economic Conference, met recently at Geneva. Joseph Avenol, secretary-general-elect of the League of Nations, opened the sessions. Under the presidency of Dr. L. J. A. Trip of the Netherlands the committee split up into two subcommittees, one on monetary and the other on economic questions.

The discussion of the monetary committee on the gold standard showed a general agreement in favor of its restoration. Views were exchanged on price levels, exchange difficulties, movements of capital and financial organization and practice. The economic subcommittee, after taking certain preliminary steps, will discuss at its sessions quotas and other trade obstructions, tariff policy, producers' agreements and monetary normalization. Mr. Avenol in his opening address warned the committee that the situation is now "so grave as to make success absolutely indispensable."

▼

Drop in Manufacturing Shown by U. S. Census

Figures just compiled by the U. S. Bureau of the Census show the total value of electrical machinery, apparatus and supplies manufactured in the United States in 1931 to be 49.5 per cent below similar production in 1929, the last previous census year. The output of last year was $969,825,713, excluding radio products, against $1,918,733,253 in 1929.

The total for 1931 is made up as follows: Insulated wire and cable, $120,632,610; motors (except fan motors) and motor parts and supplies, $94,707,742; batteries and battery parts and supplies, $85,945,271; incandescent-filament lamps, X-ray tubes, etc., $70,426,394; industrial, commercial, and household apparatus and appliances, $67,760,433; switchboards, circuit breakers, and switches, $44,283,200; transformers, induction voltage regulators, and current-limiting reactors, $42,709,918; generating apparatus and parts, $33,951,086; conduits and fittings, $29,082,516; ignition apparatus for internal-combustion engines, $27,805,983; measuring instruments, meters, relays, and instrument and meter transformers, $22,674,488; control apparatus, $22,159,126; wiring devices, $21,750,099; electrotherapeutic and electromedical apparatus, $9,060,690; electric fans, $8,648,690; fuses and fuse blocks, $7,741,381; miscellaneous electrical equipment, $260,486,086.

Establishments engaged primarily in the manufacture of electrical machinery, apparatus and supplies contributed $917,515,744. The remaining $52,309,969 represented the value of such commodities made as secondary products by establishments engaged primarily in other lines of manufacture.

The analysis covered, in 1931, 1,389 establishments, employing 180,064 wage earners, to whom $204,439,546 was paid as wages. Materials, fuel and purchased energy cost $337,304,003. The value added by manufacture was $658,184,546.

▼

Ontario Hydro Cleared by Royal Commission

That the Ontario Hydro-Electric Commission acted with propriety throughout in its dealings with the Beauharnois Corporation and John Aird, Jr., and in the purchase of the Dominion Power & Transmission Company of Hamilton is the opinion of the Royal Commission, which investigated these transactions and has just issued its report.

Signed by Justices W. R. Riddell and G. H. Sedgewick, the report upheld the propriety of the payment of $50,000 by the hydro board to Mr. Aird in the purchase of the O'Brien power interests and ruled that the payment of $125,000 by Beauharnois to Mr. Aird had no relation to the purchase of power by the Ontario commission.

▼

Puget Sound Issues Approved

Approval of two security issues for which Federal Power Commission sanction was sought has been obtained by the Puget Sound Power & Light Company. The company, which is a licensee of the commission, supported its application with complete financial exhibits, an independent engineering appraisal report and a statement of the purpose of the issue. Acting upon this showing, the commission by formal order authorized the issuance of first

and refunding mortgage 6 per cent gold bonds, series "E," due October 1, 1950, in the principal amount of $7,500,000, and of $3,000,000 7 per cent secured convertible notes due October, 1937.

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Rehabilitation Committee Reports on $70,875,000

Reporting upon the activities of the National Committee on Industrial Rehabilitation, A. W. Robertson of Westinghouse, chairman, has made public a list of organizations which have responded to the appeal made by the committee to the extent of declaring that they would spend in the aggregate more than $70,875,000 for new machinery, equipment and plant facilities and for general remodeling and modernization in various industrial plants and retail establishments.

These figures represent, according to Mr. Robertson, a gain of about 2 per cent of the total annual loss of income now suffered by the capital goods industries. Normally, these industries have an annual income of $5,000,000,000. This has dropped to a little more than $1,000,000,000, "so it can be seen that the commitments reported actually have reduced the expected loss for 1932," he said, adding that "the outlook for success in the movement is bright, for the real work has just begun."

Heading the list of agreed expenditures are: American Telephone & Telegraph Company with $35,000,000, Standard Oil Company of New Jersey with $20,000,000 and Pacific Gas & Electric Company with $5,000,000. Another utility company which has signified its intention to participate is the Montana Power Company, with $100,000. Manufacturers reporting from the electrical field are: Westinghouse Electric & Manufacturing Company with $1,260,000, Allis-Chalmers Manufacturing Company with $200,000 and Crosley Radio Corporation with $500,000.

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Bills Must Be Rendered in Service Company's Name

All bills sent by utility companies in New York state to their customers on and after March 1, 1933, must bear the names of the corporations actually providing the service, instead of the names of the holding or affiliated companies, according to an order issued recently by the Public Service Commission. A report which accompanied the order stated that the ruling had for its purpose, among other reasons, the desire to prevent the sale of securities of holding and affiliated companies to consumers who might be misled by the names on the bills to believe that they were purchasing the issues of the company providing the service. Referring to the existing practice of many gas and electric companies of billing with the name of the operating company inconspicuously printed under that of the holding company, the report declared that "no useful purpose is served," but that "the obvious result of this practice is to advertise the name of the holding company and promote the sale of its securities."

The order also prohibited the imposition of penalties for slow payment of bills. The report stated that giving discounts was a preferable method of expediting payment, producing the same results as the penalty system, without its coercive features. This anti-penalty order, also effective on March 1, and for three years thereafter unless changed by the commission in the meantime, is directed specifically at companies furnishing gas, electric, steam, water or telephone service. The order provides that discounts shall not exceed 10 per cent on the first $10, plus not to exceed 3 per cent on any excess over $10, except that a minimum discount of 15 cents a bill may be allowed.

The orders require the printing on the backs of bills of various data relating to rates and classification for the information and convenience of consumers. They also require that bills show on their face the present meter readings and date of taking, together with quantity registered and gross amount of the bill, as well as the date the discount period expires.

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Japanese Lamp Menace Fought by Workers

Opposition to the invasion of the American market by the Japanese lamp manufacturer (ELECTRICAL WORLD, October 22, 1932, page 551, and October 29, 1932, page 584) gained impetus last week when more than 100 men and women workers in the Buffalo Lamp Works of the General Electric Company organized as a committee to obtain action from the United States Tariff Commission to raise the tariff on electric bulbs. The Buffalo Works closed on November 1, when the officials found that the domestic market had been swamped by the Japanese manufacturers, underselling the local product. Approximately 400 employees were released.

In four years since 1928 importation of Japanese electric lamps has increased 140 per cent, despite the duty which in the 1930 tariff act was placed at 20 per cent on incandescent lamps without filaments and with metallic filaments and at 30 per cent on lamps with carbon or other non-metallic filaments. The estimated importation from Japan this year of 88,800,000 lamps is the equivalent of a year's work by 1,595 persons directly employed in production of lamps in the United States.

The greatest increase in importation of Japanese lamps has been in miniature lamps, principally for Christmas tree lighting. In 1928 the United States imported 18,000,000 miniature lamps, of which 16,000,000 were for Christmas tree use. In that year Westinghouse Electric & Manufacturing Company's lamp subsidiary, Westinghouse Lamp Company, sold 12,200,000 Christmas tree lamps and General Electric sold 34,073,000. Japanese products in that year accounted for only 27 per cent of sales of Christmas tree lamps. It is estimated that Japan will send this year 54,400,000 miniature lamps; domestic manufacturers will have to divide a market reduced to 12,000,000.

The remarkable success with which these Japanese lamps have been marketed has been due to the extremely low selling price.

Major New Construction This Week

Heavy-duty motors, controls, transformers, electric pumps, compressors, regulators, etc., will be installed by Sinclair Refining Company, Fort Worth, Texas, in a $500,000 project.

Extensions to underground system of Atlantic City (N. J.) Electric Company, to cost about $600,000.

Bids asked until November 17 by Metropolitan Water District, Los Angeles, Calif., for fifteen 2,000-kva., 45 333-kva. and 24 250-kva. transformers, five 5,000-kva. synchronous condensers, ten 69,000-volt, ten 34,000-volt, 42 7,500-volt and fifteen 15,000-volt oil circuit breakers.

Heavy-duty motors, machine drives, transformer equipment, regulators, conveyors, etc., will be installed in new wire and cable mill of John A. Roebling's Sons Company at San Francisco, Calif.

Electric pumping machinery, power plant equipment, transformers, motors and controls needed for plant of Ozark Chemical Company, at Soda Lake, near Monahans, Tex. A $300,000 project.

Motors and controls, compressors, pumping equipment, etc., for oil refinery at Farmers Valley, Pa., of Quaker State Oil Refining Company. Cost over $300,000.

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New York Metal Prices

	Nov. 1, 1932 Cents per Pound	Nov. 9, 1932 Cents per Pound
Copper, electrolytic	5.38	5.3125
Lead, Am. S. & R. price	3.00	3.15
Antimony	5.50	5.75
Nickel ingot	35.00	35.00
Zinc, spot	3.35	3.35
Tin, Straits	23.35	23.80
Aluminum, 99 per cent	23.30	23.30

Kelvinator Sales Up 170 per Cent

Unit shipments by Kelvinator Corporation during the month of October were 9 per cent higher than for any October in the history of the corporation and 170 per cent greater than for October, 1931, it is announced by H. W. Burritt, vice-president in charge of sales. "We feel that the establishment of an all-time record for October, coming at this time when sales resistance is high, is an accomplishment of great significance," said Mr. Burritt.

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New Rate Schedules in Missouri

Missouri Public Service Commission has ordered the Missouri Utilities Company to file new schedules for electric rates affecting 25 cities and towns in southeast Missouri. It is estimated the new rates will save the consumers of electric current furnished by the company about $100,000 annually. The commission's order resulted from an investigation that has been under way since 1927.

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Rural Line Extensions Not Taxable

Amounts paid on electric bills for the purpose of reimbursing the power company for the extension of lines into rural areas are not taxable, and where transmission lines are constructed into a partially settled territory and the cost of the extension is charged against the users of electricity the Bureau of Internal Revenue advises that there is nothing in the law which requires the addition of the 3 per cent tax to such installments.

▼

Defective Cords to Be Replaced

As a result of the drive against defective wiring in Chicago recently (ELECTRICAL WORLD, November 5, 1932, page 615), W. A. Jackson, city commissioner of gas and electricity, has announced a new "bracelet wire" to replace defective and "bootleg" electric cords. The new wires have small bracelet-like safety tags of four colors attached every 5 ft. The different colors are used to distinguish wiring suitable for different services.

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Air-Conditioning Business Active

Air-conditioning products are finding so receptive a market at the present time, according to the General Electric Company, that approximately 2,500 men have been put to work in connection with the manufacture, sale and installation of the new General Electric oil furnace and other air-conditioning products. J. J. Donovan, manager of the company's air-conditioning department, states that to meet unexpected demands, an order was recently placed on the factory increasing by 50 per cent the furnace production to the first of the year.

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If the service charge doesn't benefit anybody but the Georgia Power Company, then the service charge ought to be abolished.

P. S. ARKWRIGHT,
President
Georgia Power Company

[**Faced with an agitation for lower rates with the service charge as a special target, Mr. Arkwright has undertaken to demonstrate to his customers that about 66,400 consumers now obtain their energy under a lower rate than if the old style rate without service charge were still in effect and that the service charge has decreased the rates of the majority of residential users.**]

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Eureka Cleaner on Full Schedule

Resumption of full-time, 5-day-week operation with staggered employment has been resumed by the Eureka Vacuum Cleaner Company. According to Fred Wardell, president, sufficient orders are on hand to run the plants of his company at the present rate for the balance of the year.

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French Liner Rates 160,000 Hp.

Four of the largest motors ever built for any purposes will propel the new French superliner *Normandie*, launched at St. Nazaire on Oct. 29. These motors are rated at 40,000 hp. each, giving the new ship a rating of 160,000 hp. These four synchronous propulsion motors and all auxiliary electrical equipment for the *Normandie* were built by Als-Thom, French associate company of the General Electric Company. Previous records for motors on shipboard are said to have been held by the two airplane carriers U.S.S. *Saratoga* and *Lexington*, which are both fully electrified ships.

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Cleveland Municipal Expanding

Reporting to the Cleveland City Council last week, Utilities Director A. R. Brueggeman stated the municipal light plant to be obtaining new customers at the rate of 100 a week. "I think people are taking advantage of the lower rates offered by the municipal light system," Mr. Brueggeman said. "We have been actively soliciting new business, concentrating especially on areas where we are well equipped to serve." Because of the increase in the plant's patronage, the Council utilities committee authorized Mr. Brueggeman to buy 1,930 new electric meters at a cost of approximately $20,000. Active efforts to secure customers for the project are being made.

Georgia Power Tower Dynamited

Explosion of two heavy charges of dynamite last week wrecked a tower of the Georgia Power Company carrying two 120,000- and two 19,000-volt lines. An interruption to service resulted generally throughout Atlanta, but other power lines soon took on the load. Last summer, through advertisements in the local newspapers, the Georgia company offered rewards for information regarding persons guilty of such vandalism (ELECTRICAL WORLD, August 20, 1932, page 231).

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Electrified Train Test in England

The first electrified train between London and Brighton, England, made a successful test trip on November 1 when the current was switched on at the Brighton station of the Southern Railway at midnight. The highest speed attained was 55 miles an hour. Tests will be made daily in slack hours until New Year's, when electrification will be inaugurated for regular service.

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British Set New Speed Record

Previous European electrical construction speed records are said to have been broken by the completion at the Rugby works of the British Thomson-Houston Company of an electric rolling-mill motor, weighing 180 tons, in 50 days. The contract was secured from the Tata Iron & Steel Company for its rolling mill at Jamshedpur. News of order acceptance arrived at Rugby by telegraph August 19, and under extreme penalty the motor had to be designed, made and placed on board ship ready to leave Britain in ten weeks' time. A record for speedy production of equipment in this country was made last August by the General Electric Company when it shipped two 10,000-kw. waterwheel-driven generators to the purchaser 41 days after receipt of the order (ELECTRICAL WORLD, Sept. 3, 1932, page 295).

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Dallas Output Rises

In forwarding to the preferred-stock holders the 54th consecutive dividend check, President C. W. Davis of the Dallas Power & Light Company advised them that from January 1 of this year to September 30 the company delivered 6 per cent more kilowatt-hours to residential customers than in the corresponding period last year. Revenue from this source was 4 per cent greater. The improvement is largely attributed to greater use of electrical appliances sold by Dallas merchants with the support of educational and promotional work conducted by the company.

Steel Poles Compete With Wood in Distribution

Based upon the contention that steel poles should displace other forms of overhead line support because they excel in low total cost for a completely erected system and have other advantages, the use of electrically welded steel poles is reported to be increasing in Great Britain. According to the *Welder* (England), nearly 300 poles of this type have been erected during the past year in Britain for both low- and high-tension overhead lines.

Welded poles are cited as being so strong that greatly lengthened spans may be used, to have long life, be easy to erect, etc. The design developed involves mild steel in hollow rectangular cross-section, tapered or stepped from the base upward and welded continuously throughout the length. By welding-on end-plates the top and bottom are sealed and internal corrosion is prevented.

Other advantages have been summarized as: They are stiffer than wood poles for the same strength and offer less deflection for the same load; their torsional strength is great because of their box section; they are almost unbreakable (when overloaded they bend, but do not fracture); they stand rougher handling better than timber, which may split if rough-handled in cold weather; in many cases they require no grounding wires or similar provisions; they can be easily and cheaply modified in design either before or after erection to suit the different requirements of additional loads; standardization is simple; no parasite or rot is encountered and any good corrosive paint will serve as a priming coat; the total finished cost of such an overhead line is no more than the finished cost of a line employing wood poles and is generally less, and they are pleasing in appearance even when close by.

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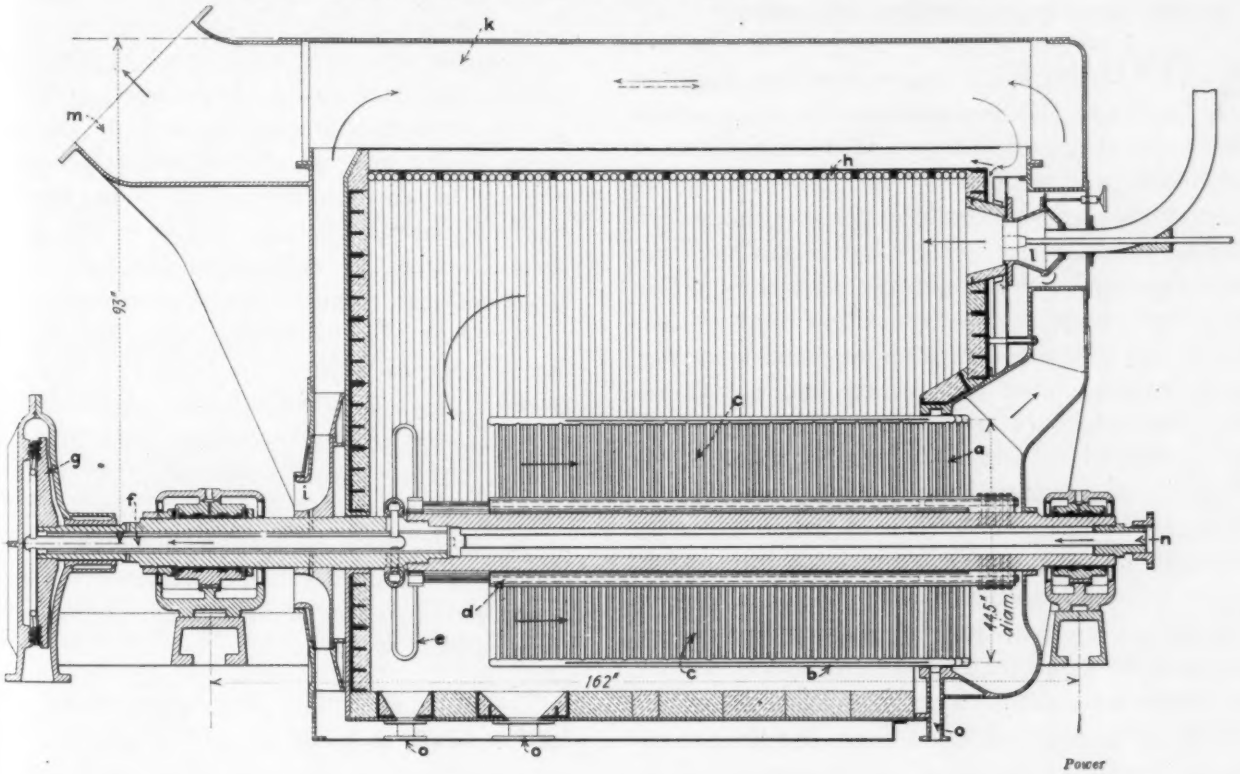
Rotating Boiler Would Eliminate Many Steam Auxiliaries



a Water supply tubes, *b* and *c* evaporator tubes, *d* steam collectors, *e* high-pressure superheater, *f* steam collector tube, *g* turbine, *h* reheater, *i* fresh-air compressor, *k* air heater, *l* burners, *m* waste-gas flues, *n* water supply pipe through the hollow shaft of the coupled generator, *o* ash and dust discharge connections.

If experimental work with a small scale installation justifies the early hopes of its developers one may perhaps bid farewell to conventional steam turbo-generator practice and greet a new form of generating unit in which the high-pressure boiler rotates with the turbine shaft, eliminating feed pumps and draft fans and much of the familiar bulk of steam boiler plant. The development is the product of the Gesellschaft für La Mont-Kessel und Kraftwirkschaft m.b.H.

Essentially the development involves a return-bend tube system which is rotated, into which water is led through a hollow shaft and then thrown outward into the tube loop. The other leg of the tube system is subjected to the heat of the gas, oil or pulverized fuel flame and it is there that steam is generated. The steam is then led to the turbine directly. The high speed of rotation creates sufficient centrifugal force to bring the water into the steaming area, thereby eliminating feed pumps. The action of the rotating elements is such that no draft fans are needed. With a simple experimental model it is said that steam pressure up to 425 lb. per square inch absolute were obtained at 2,200 r.p.m.

According to recently published data offering a comparison between the cost of a 4,000-lb.-per-hour steam power plant consisting of boiler, feed pump, fans, auxiliary turbine and generator and a careful estimate of the new plant a saving of about 60 per cent in construction costs might be shown. Space savings are notable.

The accompanying figure shows a proposed 3,000-r.p.m. unit to deliver 4,000 lb. of steam per hour at a steam pressure before the revolving nozzles of 1,700 lb. absolute. Steam temperature before the nozzles 716 deg. F. Expansion in the turbine to 355 lb. absolute. Reheating at 355 lb. absolute to 842 deg. F. Output to be delivered at the coupling, 500 to 600 kw. Heating surfaces: Evaporator, 710 sq.ft.; high-pressure superheater, 21.5 sq.ft.; reheater, 376 sq.ft. (tube circumference).

EDITORIALS

L.W.W.MORROW
Editor

Capitalizing commission hearings

ATTENDANCE at commission hearings has burdened utility executives for many years. Most operating officials would rather tackle a tough job in construction or emergency repairs any day than to sit around a hearing room feeling like pawns in a semi-legal battle and enduring the slings and arrows of outrageous heckling from the noisy fringe of the opposition without loss of temper. On this account some executives may be inclined to hope for greater use of the so-called interrogatory method of conducting a rate case, under which a series of leading questions is presented in written form for the company to answer instead of subjecting so many witnesses to verbal examination. The supposition, however, that this procedure will shorten a case is open to grave doubt, judging from recent experience in Massachusetts, and present indications are that there is no short cut in regulatory procedure readily to be realized apart from the limitations placed by an experienced commission upon inquiries.

In the pending Boston Edison rate case Chairman Attwill of the Bay State commission announced recently that the petitioners' method of presenting formal interrogatories to the company aroused his dislike on the ground that it takes too much time; that it does not enlighten the public; creates no public interest in the hearing, and in general results in a mass of detail which is of no assistance whatever to the board in determining the issue. Many of the inquiries were deemed irrelevant and were disallowed by the commission. Some appeared to be mere attempts to fish for sensational catches and others placed undue cost upon the company to determine. When all is said and done, nothing can better reveal company policies and acts than direct testimony by responsible officials frankly meeting the inquiries of the opposition and the by-standing public alike. It is well to read into the record the facts which guide utility policies, and a properly conducted hearing is an opportunity to show the public truths about management and its problems which should always be utilized to the full. In controversial cases the presence of company executives clears the air surprisingly, and the mere interchange of written questions and answers between counsel is a pretty lame method of progressing toward well-rounded adjudication of issues. Most commissions strive to free their hearings from the formalism of the courts, and as a result state regulation displays a vitality which never could have been attained without the active participation of interested company executives and key men.

Let's save a year

AT THE meetings last week of the fifteen committees of the N.E.L.A. National Sales Section in Chicago one thought stood out—the need for action in the commercial branch of this association. The report of each group at the joint session that concluded the conference reflected the same attitude, that this is no year for research and deliberation. Gross sales by the utilities are off—though happily in no such measure as most other industries have suffered—and there is a selling job to be done.

Were it not for the fortunate fact that residence load has actually increased during the three years of this depression, because people have stayed home and used more light, the story would

be a very different one. Industrial power, industrial heat and commercial lighting have dropped off. Household appliance sales have dwindled. But domestic consumption has increased and absorbed these losses in large part. What a service—more needed in bad times than in good. What a market—to grow greater under depressions. What a business—founded in the impregnable security of the American home.

So the committees plan to work on programs that will promote the industrial, commercial and domestic uses of electricity, for the economies they offer. They will endeavor to capitalize their special values this year. But it should not be overlooked that time is the very essence of the opportunity. It will not do this season to report progress at the spring conference and complete the plans for the convention early in the summer. What work is to be done should be performed at once. Let's save a year by doing the job now. Let's put the programs into use this winter instead of next fall.

Needed, a clearer terminology on phases

FAULTS are called single phase, two phase or three phase, but what is a phase? To the lineman a phase is one of the conductors. To the meterman and the industrial user a phase is one of the voltages between pairs of wires. To the machine designer a phase is one of the windings. To the relay engineer and the co-ordination engineer a phase may be either, both or neither.

The way out of the confusion is to use, whenever there can be any ambiguity, the longer expressions "phase to neutral" and "line-voltage phase" to differentiate. At least the protection engineer could safely use the less ambiguous term "single-wire fault" to indicate a ground fault of a single conductor. "Two-wire fault" would then mean two of the phases to neutral grounded and therefore entailing a single-phase short circuit in addition. As for three-phase faults, there is little choice in terminology.

What the situation needs is a definite pair of terms that would leave no doubt whatever whether one is talking of the voltage between conductors or the voltage from conductor to neutral or ground. The three-phase system has been the fashion long enough to deserve clarity of this sort. It has been bad enough to have the square root of three to bedevil all three-phase inter-relations without adding cumbersome indirectness of terminology to increase the nuisance.

"Sell the seller"

IF A slogan is needed for the National Sales Section of the N.E.L.A. the phrase "Sell the Seller," which sums up the recent meetings of the section committees in Chicago, should be adopted as a temporary war cry. Let us hope that it need be only a temporary one. Whether it was the National Electric Cookery Council hard at work getting the range campaign accelerated, the home wiring committee trying to find a way to increase the number of outlets in homes, the water-heater and air-conditioning group prying open these great potentialities, the power salesman developing strategy to be employed against competition, the complete home electrification program trying to get itself started, or whatever committee meeting the observer chose to visit, everywhere was met the expressed necessity of selling the utilities themselves in all lines of commercial activity. Quite evidently it is perfectly proper to classify the electric utilities exclusively as "service" institutions. Certainly one cannot put them in the class of commercial enterprises so long as utility salesmen continue to emphasize the necessity of selling their own executives on electric ranges, water heaters, air conditioning, and what not.

The present job of the electric utilities is to sell kilowatt-hours. The necessity to sell energy will probably become more, rather than less, urgent in the future. In the past the electric utilities did not sell kilowatt-hours; they merely supplied a demanding market. Fifty years of history in which, practically speaking, the customer came and took the product away from the supplier, does not give to the electric utilities or even appliance manufacturers a background of selling traditions and experience against which can be painted a picture of large-scale commercial development. Yet the electrical industry must paint that picture if it is to grow into the place it should occupy in present and future business. Let us get busy and "sell the seller," and get that job done quickly so that all attention and effort can then be directed at selling the market.

System Losses—

Evaluation and allocation. Effect on system capacity and energy charges, system planning and operation.

By Herbert Estrada,* B. E. Hagy and A. H. Kidder

Philadelphia Electric Company

DETAILS of allocating losses to the respective parts of the system in which they occur will be different in each system and will change from year to year with changes in layout or operating practice in any given system. In the Philadelphia Electric Company system the losses have been allocated (within the limits of engineering accuracy) with the assistance of the following practically minimum number of kilowatt-hour metering points:

1. Generator output.
2. Interconnection, input and output respectively.
3. Purchased energy.
4. Rotary conversion apparatus input and output.
5. Distribution substation transformer output.
6. Customers' services.
7. Company use.

Hourly readings (in some cases only readings taken at the time of the apparatus peak) from indicating ammeters, voltmeters, and occasionally watt-meters and reactive-kva. meters, all installed for normal operating purposes, assist materially in allocating system losses.

The kilowatt losses at the time of the system peak may be calculated from a knowledge of the apparatus in operation, its characteristics and loading. Usually, the dielectric, iron and other more nearly constant losses are calculated separately from the I^2R losses. In other cases the use of over-all efficiency curves simplifies the work. I^2R losses are calculated directly where ampere readings are available. In the secondary system a reasonable approximation of the I^2R losses was obtained by the use of such relations as can be established between per cent power loss and the average voltage loss, resistance, reactance and power-factor characteristics of this system. Losses during the year may then be derived from kilowatt losses at the time of the system peak, by taking proper account of diversities and annual load factors.

Evaluation of Losses—The determination of the weight which should be given to incremental differences in losses in the selection of equipment or in the choice of two alternate developments for a given project requires a careful method of approach.

The proposition having the lowest loss is usually the most expensive of the various alternates. The problem fundamentally is to determine whether the higher cost can be justified by the lower losses which accompany it. In view of the importance of keeping capital costs to a minimum, the method of evaluating losses should be such that undue weight is not given to differences in losses. To justify additional expenditures, in general, the more efficient proposition must operate at high load factor for an extended period, and if the equipment is retired prematurely or unexpectedly changed from base-load to peak-load operation, which is not a rare occurrence, its relatively higher efficiency will be of little or no real value.

Of the two possible errors in the evaluation of losses in connection with the purchase of equipment, (1) giving too much or (2) giving too little credit for losses, the former is to be avoided particularly because capital expenditures on which carrying charges must be paid are more important than the offsetting value of the increased losses which will gradually accrue only if the equipment is kept in service at high load factor for a long period. A factor often overlooked in this connection is that a dollar of operating cost several years hence can be paid for by a fraction of that sum deposited at the time of purchase and allowed to grow at compound interest.

The most difficult factor to evaluate properly in economic comparisons is the difference in the peak-load losses of the various alternates.

System Capacity Charge—If the addition of incremental losses over the peak requires a like addition to the system capacity, the more efficient apparatus should, of course, be given credit for the lower peak losses at the estimated cost of system capacity for additions to present plant. However, the addition of a small loss over the peak, in any event, will not immediately require the addition of system capacity, but, in the extreme case, may make it necessary to increase system capacity one year prior to the time when this increase would be required by load growth. As a maximum, therefore, the proposition having the lower loss could be credited only with its proportion of the present value of the carrying charges on the additional system capacity required during some one future year, when all the incremental peak loss additions would accumulate to a sum large enough to require such additional system capacity. The time in the future when this would occur is, of course, difficult to determine, but even if only a few years' delay is assumed the magnitude of this item is reduced considerably. Carrying this line of reasoning still further, it will appear in almost every case that these small, differential values of losses alone will never actually change the schedule for installing system capacity, with the result that the credit for system capacity due to lower losses is eliminated altogether as a factor in economic comparison work. In this connection it is, of course, necessary to distinguish between the total system losses which often in the aggregate are enough to require, for instance, a generator and the smaller differential losses between the various similar propositions that have been consid-

*Based on paper presented before N.E.L.A. power systems engineering committee.

ered over a term of years, which even in the aggregate become relatively insignificant.

It is possible that certain operating costs may be sufficiently proportional to increments in the average daily peak load prepared for to permit their being capitalized and credited to the proposition having the lowest peak-load losses.

Energy Charge—The average cost of energy includes a number of factors, such as supervision, also a portion of labor, maintenance, etc., which are independent of the kilowatt-hours generated, with the result that the increment energy costs applicable in economic comparison work are much lower than the average costs. The increment energy cost, therefore, becomes principally the bare fuel cost and will not exceed a few mills per kilowatt-hour in the usual case. Since this cost is affected directly by cost of coal, it is difficult to estimate its magnitude over a period of, say, twenty years in the future. In most cases we are forced, because of inability to predict future costs, to use present costs, unless there is some definite information indicating otherwise.

Having determined the annual value of the energy loss, it should be capitalized at the rate for annual charges prevailing in the particular property involved and the result added to the capital figure already established for peak-prepared-for costs. This total is the capitalized preference of the more efficient proposition over the less efficient or is the maximum additional money which can be justified for the more efficient proposition due to lower losses. This result may be further modified by the introduction of such factors as: (1) diversity, which of course would apply only to the peak-prepared-for item, (2) profit, included on the basis there should be a profit on the transaction, and (3) obsolescence, which is sometimes introduced to cover the possibility of unforeseen changes in future operating conditions so higher efficiency would not be as effective during the useful life of the apparatus as had been estimated. These factors, together with the use of the present value of money to be saved in future years, will all have the effect of reducing the value of losses.

While the importance of reducing losses by improved operating methods and by careful system planning is unquestioned, it is quite possible that too much emphasis may be placed on losses in economic comparison work, such as purchase of apparatus. Advantageous qualities should be recognized in equipment purchasing, but the results of a too liberal evaluation of these qualities will in the long run considerably affect capital investment.

The public utility must supply service at the minimum cost consistent with reliability. Its capital investments must be such as to improve or extend the ability of the utility to render service. Capital should not be used by a utility for the purchase of more expensive apparatus than necessary without practical certainty that the additional cost, plus a reasonable profit, will be recovered in, say, ten years. The capitalization of losses in economic comparison work is merely a convenient tool for reducing the differences in losses between competitive propositions to their financial equivalent in order that superior design with respect to losses as well as in other respects may be properly recognized.

Effect of Losses Upon System Plans—The percentage of losses in the Philadelphia Electric Company system has reduced approximately one-third during the past fifteen years, due principally to causes such as outlined below:

1. Increased proportion of load distributed at 13.2 kv. or higher voltage. At present, approximately 40 per cent of the total light and power load on the system is supplied in this manner.
2. Reduced average 13.2-kv. transmission distance.
3. Shorter average distance from substation to center of distribution.
4. Introduction of 4-kv. primary distribution in suburban areas.
5. Increased efficiency of transformation and conversion in substations.
6. Improved operating methods.
7. Shorter average distance of feed on secondary mains.
8. Decreased load on the d.c. Edison system.
9. Decentralized supply of street lighting loads in Philadelphia.

While some of these factors are principally functions of load growth, others have accompanied the adoption of carefully considered plans for reducing fixed charges and operating expenses to the absolute minimum consistent with high-grade service.

Although losses were considered, there was practically no instance where the change in losses accompanying a change in system plan was found to be a controlling factor.

Effect Upon System Operation—In the operation of a large electric system transmission tie lines in the equivalent generation system are depended upon to transmit large blocks of energy from the more efficient stations in order to displace energy from the less efficient stations. These losses must be considered in properly allocating loads to generating stations as they may amount to several per cent of the total energy generated and, proportionally, increase the total generating cost per kilowatt-hour delivered from the equivalent generation system. In this case the incremental or additional losses should be used rather than average loss as appreciable error may result by the use of an average loss.

Since copper losses vary as the second power of the load, the per cent instantaneous increment loss at any load is given by the formula developed in the article "Determining Tie Line Losses," by H. Estrada and H. A. Dryar, ELECTRICAL WORLD, October 24, 1931, page 745:

$$\text{Per cent instantaneous increment loss} = AR\,\frac{Kw}{Kv^2}$$

Where:

A = a constant ($A = 0.2$ for three-phase systems)
R = line resistance or resistance to neutral
Kv = line voltage
Kw = instantaneous load

The per cent instantaneous increment loss is therefore a linear function of load. Straight lines are plotted for each transmission tie line and major transformer which readily give the per cent increment loss for each piece of equipment.

In applying the curves to determine the per cent increment loss for an additional amount of power transmitted over a line, the additional loss in per cent of the additional amount of power is actually the per cent increment loss at the load midway between the initial and

final load on the transmission line. This value is given directly by the loss curves.

Another advantage of the incremental method of treating changes in transmission line losses is that the real kw. and reactive-kva. components of a given block of power can be considered independently in determining the loss due to each component. This simplifies the effect of power-factor changes on losses and permits careful allocation of reactive-kva. as well as kw. loading.

Industrial or other loads having a main and emergency supply can usually be normally supplied from either source with equal reliability. Other factors being equal, appreciable reductions in losses can be effected by supplying the load normally over that route having the lowest incremental loss from generating station to customer. The incremental method of determining marginal losses is an effective tool in quickly and accurately determining the incremental losses in this connection. In checking the incremental losses applicable to certain loads from the equivalent generation system to the load, it has been found that these losses in certain instances are as high as 15 per cent, showing the necessity for careful consideration of this problem. This method is also applied in scheduling transformer bank and transmission line loadings in order to utilize the available equipment to the best advantage.

▼ ▼ ▼

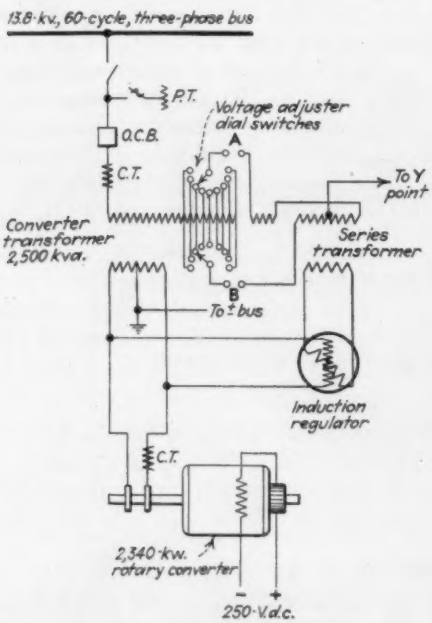
Load-Ratio Transformer Controls Rotary Converter

By OSCAR J. ROTTY
Superintendent of Substations
Union Electric Light & Power Company, St. Louis

A standard shunt converter has many advantages for Edison system service provided sufficient range of voltage can be obtained. This is accomplished in the new Fifteenth Street substation of the Union Electric Light & Power Company by means of load-ratio control equipment on the converter transformer in conjunction with induction regulators.

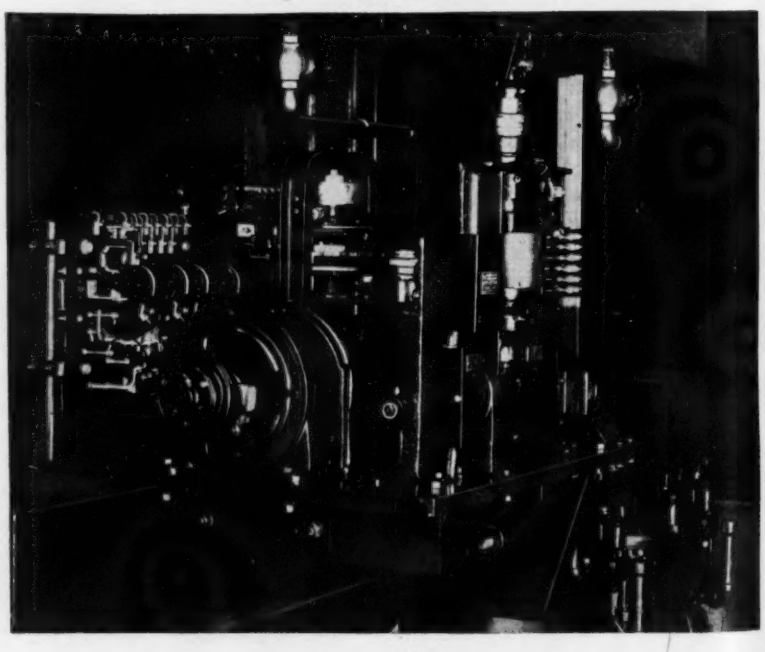
The converter is rated 2,340 kw. with d.c. voltage range of 130 to 260 volts, three-wire. The voltage curve is perfectly smooth and continuous and full load current can be carried at any point. The scheme of connections is shown in the accompanying sketch. The transformer has a 100 per cent extended winding on the high-voltage side which has eight equal taps brought out and connected to two ratio adjusters and contactors. An additional section of transformer winding in the lead through one ratio adjuster and the *A* contactor gives the effect of double the number of taps. A series transformer located within the main transformer is connected across the two contactors with its middle point brought out and connected to form the *Y* point. The other winding or primary of the series transformer is connected to the induction regulator secondaries.

Voltage control is then by adjustment of the regulator position which "boosts" or "bucks" the voltage of the main transformer primary through the medium of the series transformer. The direction of regulation depends upon which of the contactors (*A* or *B*) is closed. The regulators are of proper range so that the voltage produced when at full "boost" on one tap will be exactly equal to the voltage at full "buck" on the next higher tap and the switching from the one tap to the other can be accomplished with no voltage or load change. The ratio adjusters, *A* and *B* contactors, regulators and auxiliary control switches and position indicators are all driven from the same rigidly connected mechanism by a single motor, and once correctly set it is virtually impossible for the various parts to get out of proper timing. As the station is unattended this apparatus is controlled automatically according to the voltage and load requirements of the system.



Regulator smooths out tap changer voltage control

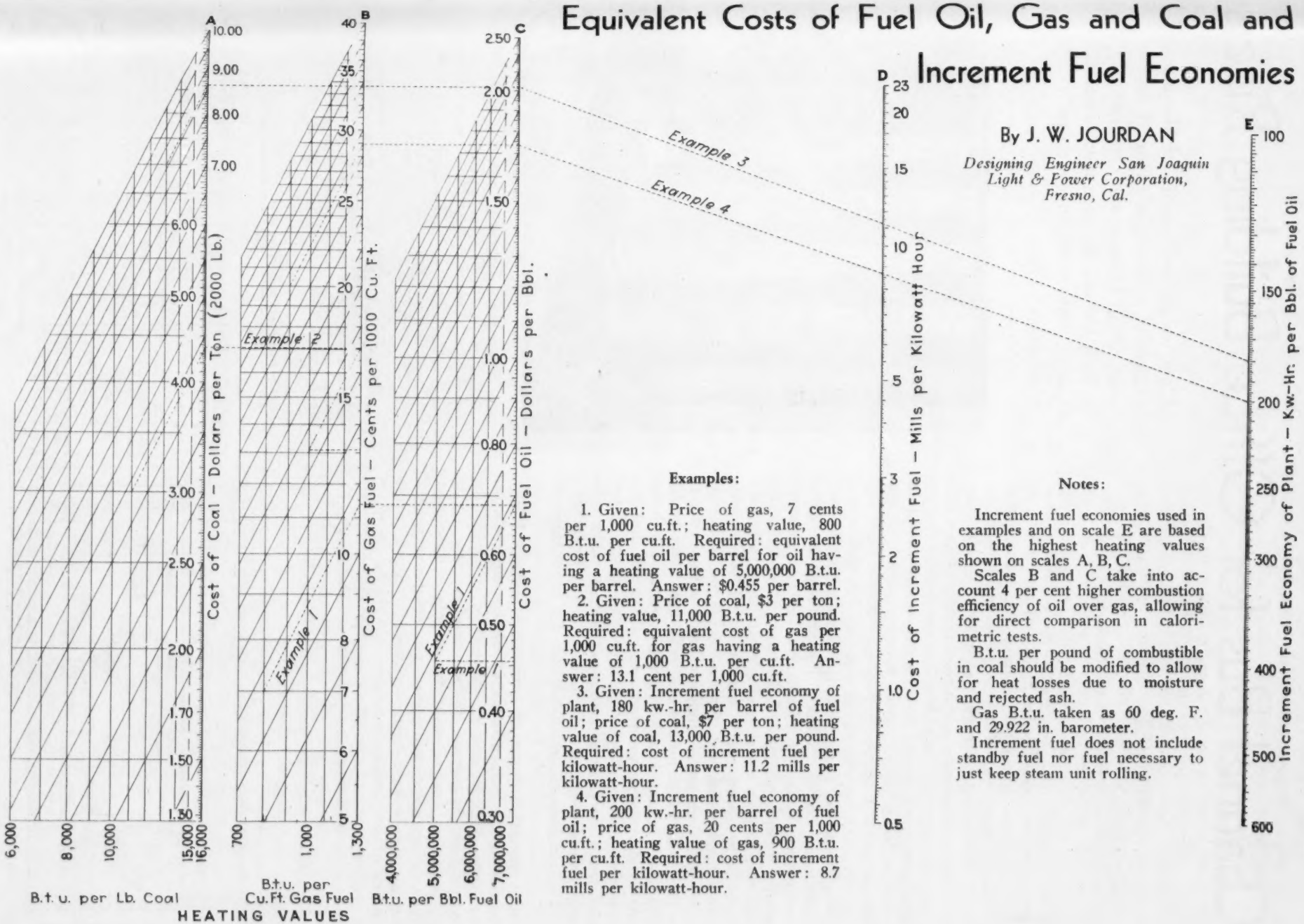
Single drive insures correct timing of regulator and tap-changer operation



Equivalent Costs of Fuel Oil, Gas and Coal and Increment Fuel Economies

By J. W. JOURDAN

Designing Engineer San Joaquin Light & Power Corporation, Fresno, Cal.


A
B
C
D
E
Cost of Coal — Dollars per Ton (2000 Lb.)
Cost of Gas Fuel — Cents per 1000 Cu. Ft.
Cost of Fuel Oil — Dollars per Bbl.
Cost of Increment Fuel — Mills per Kilowatt Hour
Increment Fuel Economy of Plant — Kw.-Hr. per Bbl. of Fuel Oil
Example 2
Example 1
Example 1
Example 1
Example 3
Example 4
B.t.u. per Lb. Coal
B.t.u. per Cu.Ft. Gas Fuel
B.t.u. per Bbl. Fuel Oil
HEATING VALUES

Examples:

1. Given: Price of gas, 7 cents per 1,000 cu.ft.; heating value, 800 B.t.u. per cu.ft. Required: equivalent cost of fuel oil per barrel for oil having a heating value of 5,000,000 B.t.u. per barrel. Answer: $0.455 per barrel.
2. Given: Price of coal, $3 per ton; heating value, 11,000 B.t.u. per pound. Required: equivalent cost of gas per 1,000 cu.ft. for gas having a heating value of 1,000 B.t.u. per cu.ft. Answer: 13.1 cent per 1,000 cu.ft.
3. Given: Increment fuel economy of plant, 180 kw.-hr. per barrel of fuel oil; price of coal, $7 per ton; heating value of coal, 13,000 B.t.u. per pound. Required: cost of increment fuel per kilowatt-hour. Answer: 11.2 mills per kilowatt-hour.
4. Given: Increment fuel economy of plant, 200 kw.-hr. per barrel of fuel oil; price of gas, 20 cents per 1,000 cu.ft.; heating value of gas, 900 B.t.u. per cu.ft. Required: cost of increment fuel per kilowatt-hour. Answer: 8.7 mills per kilowatt-hour.

Notes:

Increment fuel economies used in examples and on scale E are based on the highest heating values shown on scales A, B, C.

Scales B and C take into account 4 per cent higher combustion efficiency of oil over gas, allowing for direct comparison in calorimetric tests.

B.t.u. per pound of combustible in coal should be modified to allow for heat losses due to moisture and rejected ash.

Gas B.t.u. taken as 60 deg. F. and 29.922 in. barometer.

Increment fuel does not include standby fuel nor fuel necessary to just keep steam unit rolling.

Channel Bus for Office Building Risers

By C. A. CARPENTER

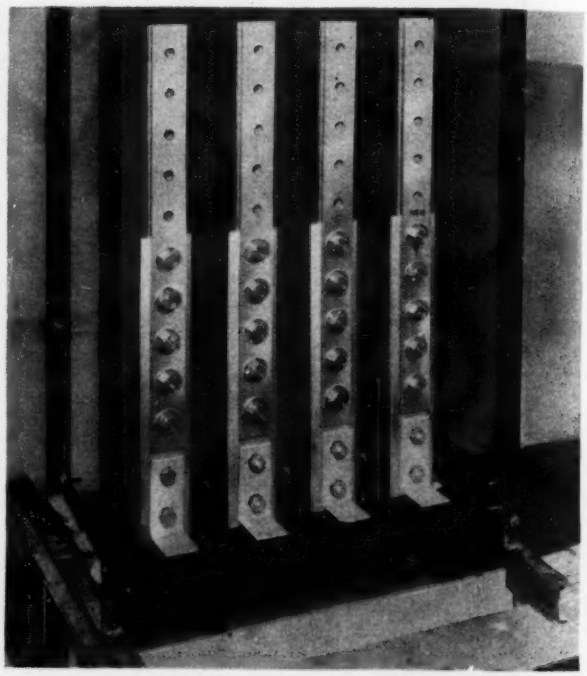
Electrical Engineer
Graham, Anderson, Probst & White, Architects, Chicago

Light weight and rigidity of aluminum channel permits single support points at centers of risers and comparatively long intervals between spacing points. Cutout cabinets mounted on riser housings.

IN CONSIDERING the general scheme of low-tension distribution in the Field Building,* a new 44-story, tower-type office building now being erected in Chicago, rigid bus and cable loops in conduit were compared. Preliminary approximate estimates indicated that the latter construction would involve greater expense than a bus arrangement. In addition, it was desired that the building network should be arranged similarly to street networks, fed at several points, in order to facilitate load interchanges and derive the maximum benefit from load diversity. As regards rigidity, it was felt that copper tubing is superior to flat busbar, at least in the direction of the minor axis of the latter. Further, considering that a maximum load of approximately 1,300 amp. would develop in some sections of the network whenever the load rose to peak values, multiple arrangement of bars would be necessary, which was considered less desirable than a single conductor per phase. Copper tubing requires special clamping fittings where connections are to be taken off, which fittings are an item of considerable expense. Channel-shaped copper conductors, which are now in the market, were not available at the time the system was being designed. However, as will be shown later, the copper channel would not have been the winning contender.

A channel-shaped conductor has the advantages of flat surfaces available for plain bolted connections and also a reasonable degree of structural stiffness. Aluminum, being the only material in which channel-shaped conductors could be secured, was selected, in spite of the necessity for the exercise of more than ordinary care in making joints, on account of the advantages mentioned. By insistence on certain special precautions very satisfactory results have been obtained as regards maintenance of low contact resistance. With the exception of the lower part of one, all six risers in the building are made with one conductor per phase. The reason for

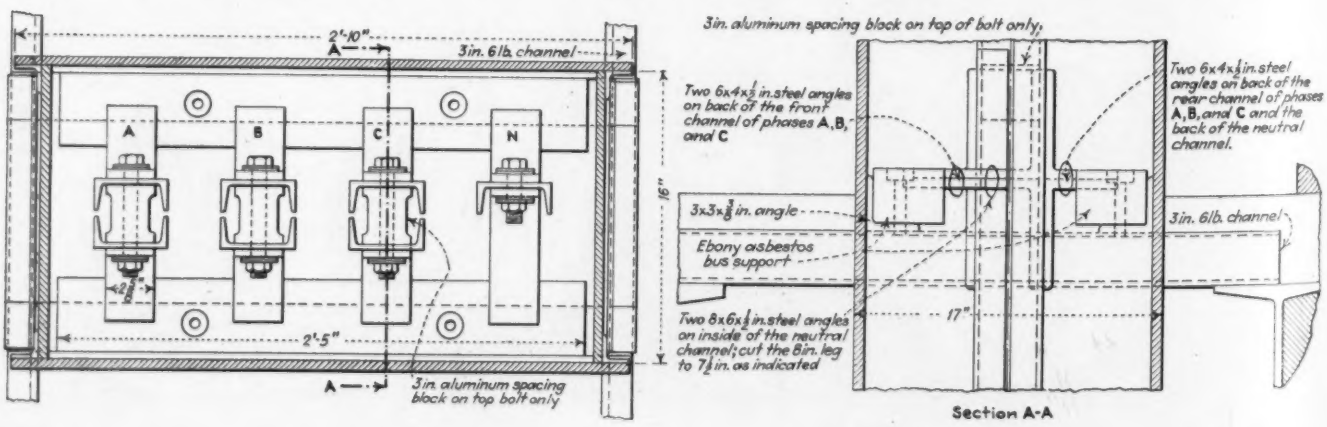
**See "Electrical World," page 218, August 13, 1932.*

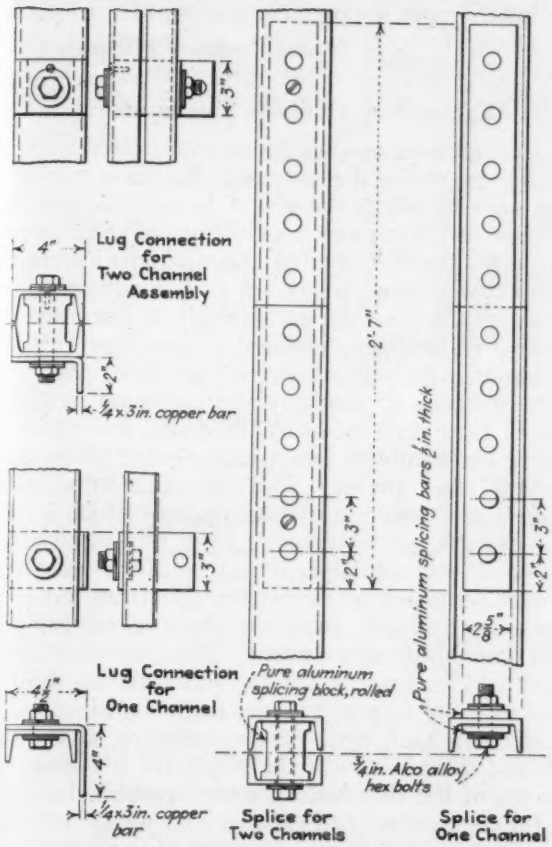


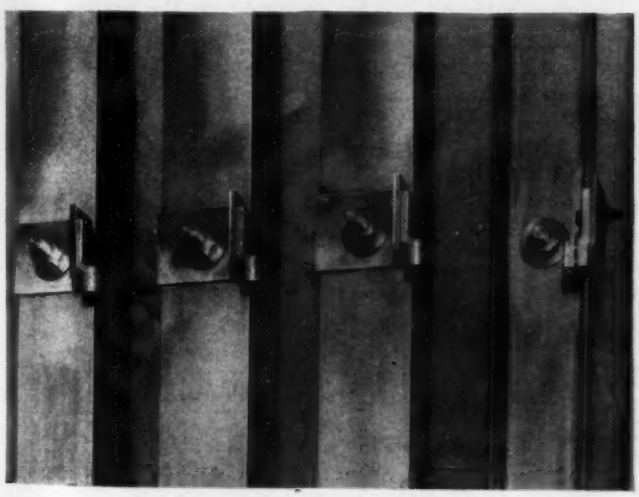
Single point support for network risers

At about the midpoint of each riser is the single support on which rests the entire weight of the four channel buses; 3-in., 6-lb. steel channels across the short plan dimension of and outside the housing carry two 3x3x⅜-in. angles extending across the long plan dimension of the housing and inside it. Inside of each angle rests an ebony asbestos block which is milled out in four places to receive the horizontal flanges of the angle sections bolted T-fashion to the fronts and backs of the buses.

The cross-section "AA" shows clearly how the angle sections are applied T-fashion to the buses. These angle sections are cadmium plated (0.003 in. deposit) and are fastened to the channels with ¾-in. aluminum alloy bolts


2'-10"
3in. 6lb. channel
A
B
C
N
2⅜"
2'-5"
16"
3in. aluminum spacing block on top bolt only
3in. aluminum spacing block on top of bolt only
Two 6x4x⅜ in. steel angles on back of the front channel of phases A, B, and C
3x3x⅜ in. angle
Ebony asbestos bus support
Two 8x6x½ in. steel angles on inside of the neutral channel; cut the 8in. leg to 7½ in. as indicated
Two 6x4x½ in. steel angles on back of the rear channel of phases A, B, and C and the back of the neutral channel.
3in. 6lb. channel
17"
Section A-A





Channel bus taps and splices

Double channel joints are made with a rolled aluminum splicing bar between the two members. The single buses are spliced with flat bars front and back of the channel. Taps are simply copper angle lugs bolted to the buses.

doubling up in the case mentioned is that the expected load on this riser would be such that more than the allowable voltage drop would occur with one channel per phase, with the riser fed from the bottom only.

The aluminum channel selected is standard material, being Aluminum Company of America electrical conductor, 4 in., 2.51 lb. per foot. In the section of the building now erected one riser has already been installed. Experience with this indicated that certain modifications of design would be advisable. These modifications have been incorporated in the plans for the other shafts, with which the descriptions and illustrations given here apply.

The arrangement of all four channels in a single row is objectionable from an electrical standpoint due to unbalanced reactance, but the local space conditions and the arrangement of the building interior made it impossible to utilize the ideal triangular arrangement of conductors. Inspection of the riser diagram† will show that, in the final arrangement, only lighting loads will be fed from the riser system. Power connections of any size will be taken directly from the four main switchboards by radial feeders. This was done so as to minimize the impedance drop in the riser by improving the power factor. As indicated on the riser diagram, support for the weight of each bus riser is at its approximate center. In this way expansion joints have been eliminated. The method of support is illustrated in accompanying drawings. This scheme is entirely practical in this building, where the maximum distance to the end of a riser from its support is not more than about 135 ft. Assuming a maximum temperature variation from 65 deg. F. to 155 deg. F., or 90 deg. F. rise, the total expansion will amount to 1.9 in. The only points at which expansion has to be considered are where bus feeders or cutout cabinets are connected to the riser, then flexible connections are utilized.

Channel splicing and spacing

In order to minimize the number of channel splices, channels have been ordered in lengths of 60 ft., or more. They will be installed from the top of the riser shaft before the latter is closed in. In order to permit connection to and provide proper spacing between the two channels where the latter are run two per phase solid aluminum spacer blocks have been designed as illustrated here. The bearing surfaces of these blocks are ground so as to afford a good contact with the inner surfaces of the channels, thus serving to equalize the load between the two members of the same phase, as well as maintain the proper spacing. The same form of spacer, in longer lengths, is used for splicing purposes. Single channels are spliced with flat bars.

In order to maintain proper alignment and interphase spacing ebony asbestos bars are to be provided at every floor or closer. The detail of these is illustrated. The vertical interval between these spacing members never exceeds 12 ft. Where the story height is greater than that figure two sets of spacers are provided.

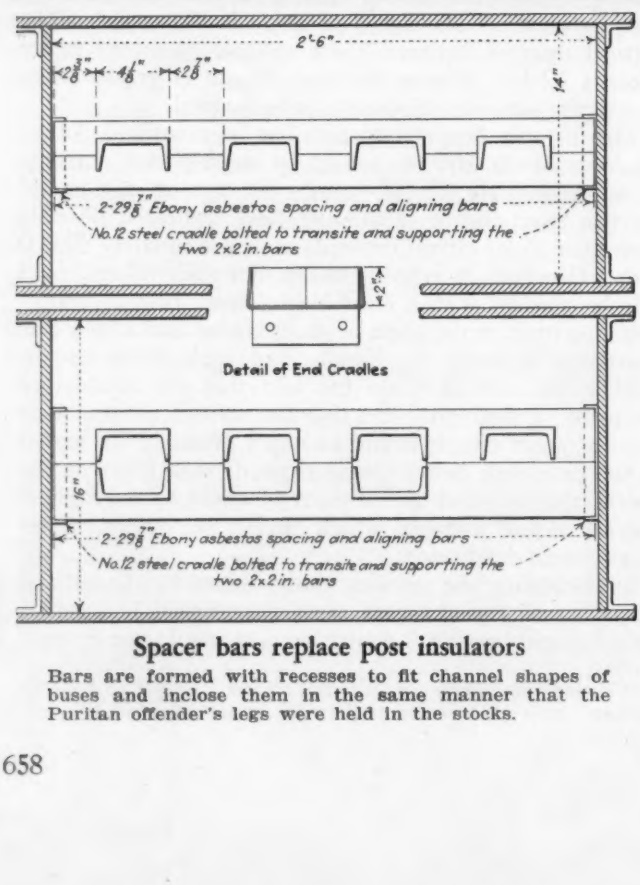
The distance between spacers has been worked out on the basis of the stresses set up by short-circuit currents of approximately 25,000 amp. Set-ups on a General Electric short-circuit calculating table indicated possible theoretical short-circuit currents of approximately 60,000 amp. However, it is to be noted that such values could only be reached with a most ideal (clean, bolted) condition of contact at the point of short circuit and a very low impedance between the supply and such short circuit. Taking into consideration the fact that the conductors are to be of aluminum and that the contact resistance at point of short circuit would be much greater than would be the case with bolted connections, it was felt that the lower value of short-circuit current would be the highest possible actual current which would be drawn under short-circuit conditions.

In calculating the stresses, those caused by the natural frequency of the channels were disregarded because of the non-rigid bracing. Assuming a safety factor of two,

†*This diagram appears in "Chicago's First Network Is a Vertical One," page 218 "Electrical World," August 13, 1932.*

the short-circuit loading comes to approximately 104 lb. per foot. Inasmuch as such loadings are comparable to those figured in connection with wind pressures in building framing, 75 per cent of the elastic limit was taken as the allowable fiber stress in the material. With these two values as a basis 11 ft. was arrived at as the maximum allowable spacing of aligning bars.

In this connection it is interesting to compare the aluminum channels with the copper product most nearly approximating it in carrying capacity. A given length of aluminum channel is about 55 per cent as heavy as the same length of copper channel. On the basis of 30½ cents per pound for aluminum channel delivered at the building and 19 cents for rolled copper channel, the aluminum channel costs 89 per cent as much as the copper. The latter has 12 per cent more resistance per foot, with corresponding increase in resistance drop and heating. In view of the restriction of allowable fiber stress in copper to 5,000 lb. per square inch, spacing bars would have to be placed 5 ft. 6 in. apart, as against 11 ft. for aluminum.


2'-6"
2⅞"
4⅛"
2⅞"
14"
2-29/8" Ebony asbestos spacing and aligning bars
No.12 steel cradle bolted to transite and supporting the two 2x2 in. bars
2½"
Detail of End Cradles
16"
2-29/8" Ebony asbestos spacing and aligning bars
No.12 steel cradle bolted to transite and supporting the two 2x2 in. bars

Spacer bars replace post insulators

Bars are formed with recesses to fit channel shapes of buses and inclose them in the same manner that the Puritan offender's legs were held in the stocks.

Aligning bars eliminate post insulators

The arrangement of aligning bars illustrated is considerably less expensive than any post insulator and clamping device with which the writer is familiar and there seems to be no reason why it should not serve the purpose equally well. Further, it offers the minimum interference with shaft ventilation, wherein it has an advantage over continuous slabs over the entire shaft at intervals, such slabs being of insulating material or provided with insulating bushings through which the riser buses pass.

In the interests of economy and minimum weight the scheme of riser shaft inclosure illustrated was developed, consisting essentially of ½-in. transite board pieces bolted to vertical steel angles. This construction affords a housing of reasonable insulating qualities which is fairly light in weight and fireproof. Since this material is a rather good heat insulator, it was considered necessary to provide some special means for circulating air in the bus inclosure to carry away such heat as might be developed due to busbar resistance. This consists of twelve ½-in. slots, 1½ in. apart, extending across the width of the transite paneling to a point 2 in. from the edges, on the right and left hand sides of the inclosure, at the first, second and third stories of the respective bus structures. At the top of the riser inclosure arrangements have been made for connection to an exhaust duct which will maintain moderate circulation of air upward in the inclosure.

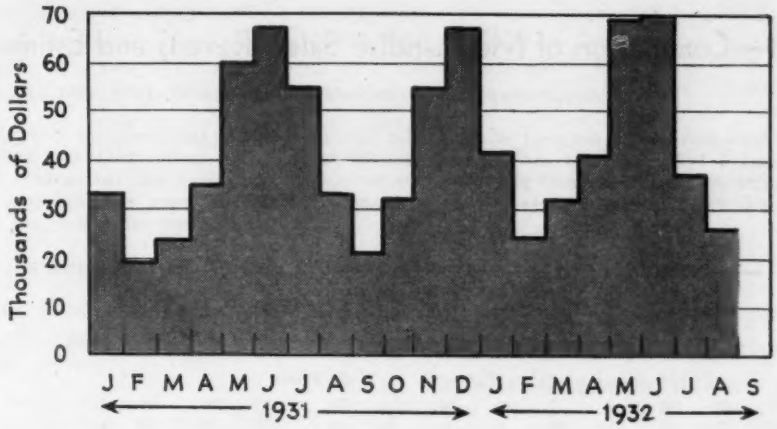
Lighting cabinets will be mounted on the angles supporting the inclosure, transite paneling being omitted behind the cabinets. Supply connections to the panels will be tapped onto the risers by the illustrated connections which enter the backs of the cabinets near the top, so that they will be readily accessible by removing the transite panel immediately above the cabinet. Connections between panel terminals and the connection brackets on busbars will be short lengths of insulated cable, to allow for movement of the bus on account of expansion and contraction.

▼

Potential Transformer Fuse Shielded Against Corona

Designed to improve the characteristics of fuses for potential transformers, Messrs. Ferguson, Pailin, Ltd., have announced a new type for oil immersion within the tanks. As described in the *Electrician* for October 21, it consists of a slender wire in a vented glass tube that is surrounded by an electrostatic shield of bakelite. For 22/33 kv. the wire length in oil is about 10 in. and the rupturing currents are less than 0.5 and 0.9 amp. The function of the bakelite tube is to minimize the corona and so prevent the deterioration and thus make a fine wire permissible.

Arc energy is kept to low values and rupture is made easier. Clearance in about ¼ cycle inherently limits the kva. which is released as energy within the tank. In addition to prompt clearance, negligible oil throw and good behavior under vibration and high oil temperature, it is stated that the fuse will carry currents just below rupturing value for long periods without deterioration.



One company's monthly financing of time paper. With care in advancing credit reverts are few

Trend in Utility Merchandising, New Revenue and Reverts

Based on reports from more than 50 utilities spread over the United States.

Why some are doing worse or better than in 1929.

The effects of shortsighted zeal to curtail expenses, the relinquishment of merchandise sales to dealer, broader dealer co-operation, lax credit scrutiny and rearrangement of time payments when customers are in straitened circumstances.

DURING a period of diminished incomes, and therefore reduced purchasing power, many merchandising problems take on added importance. In the electrical field, particularly the domestic portion, the effect on appliance sales and reverts has been of special concern to some companies.

With a view to discovering the facts the ELECTRICAL WORLD made a preliminary check survey, the results of which were published in the August 27 issue. This survey covered the far West quite thoroughly and the rest of the country only spottily. Merchandise sales for a recent twelvemonth period averaged 54 per cent of those in 1929 in terms of units sold and 57 per cent in dollars. Wide divergences in individual results were revealed, due in some cases to differences in economic conditions, shortsighted zeal to curtail sales expenses by drastic reductions in sales forces and advertising, the relinquishment of merchandise sales to dealers or the general effect of broader dealer co-operation. Even wider divergences were reported in the number and value of reverts—from a negligible amount to an increase of 75 per cent, but in one case a reduction to 1.5 per cent of sales. The unfavorable results might be ascribed in some cases to lax credit scrutiny and to reductions in sales which made the number of reverts a higher percentage of the sales. The survey included only sales by utilities and not total sales. The conclusions pointed to the necessity of aggressive merchandising, co-operation with dealers and more attention to the credit standing of customers.

But these conditions could not be considered necessarily representative of the country as a whole as they covered too few companies. Representative utilities in various parts of the country were therefore asked to contribute the results of their experience, which are embodied in the present article.

Sales—While in general sales of merchandise have been falling off, the amount of decrease varies widely. Moreover, a number of instances are on record of vigorous gains. Thus ten of the 39, or 26 per cent, sold more units in 1931 than in 1929, and five, or 13 per cent, sold more in 1932 than in 1931.

These gains were not made by loosening credit policies, for they are associated with a remarkable scarcity of reverts.

Thus in New England two companies sold more units in the twelve months ended the middle of 1931 than in the corresponding period two years before and two sold more in 1932 than in 1931. In the Atlantic states three sold more in 1931 than in 1929, and the same three made a further increase in 1932. In the Central states the figures are five and none; in the far West both reporting companies decreased, but one of the six included in the earlier survey showed a gain.

What is true of the number of units also holds, in the main, for sales in dollars. But here we encounter evidence of a shift in the kind of appliance. Consider companies 1D, 1E and 1I, in New England. Their unit sales decreased. But in dollars the sales either suffered less shrinkage or actually surpassed those of 1929. Evidently there was a shift to heavy-duty and more costly

Table I—Comparison of Merchandise Sales, Reverts and Estimated Energy Revenue

(During Twelve Months' Periods Ended June 30, 1929, 1931 and 1932)

Sales in each year are expressed in per cent of such sales in corresponding period ended 1929. Reverts in each year are in per cent of total merchandise sales during that year. Energy revenue from merchandise sold is in terms of revenue for corresponding period ended 1929.

In the few instances marked by (†) comparisons could be made only between 1931 and 1932. These were tabulated by leaving 1929 blank and rating 1931 as 100 per cent. The majority of the returns were received from subsidiaries of holding companies. Independent companies are indicated by (*i*), municipals by (*m*).

NEW ENGLAND

Company	1A	1B	1C	1D	1E	1F	1G	1H	1I (*i*)	1J (*i*)	1K (*m*)
MERCHANDISE SALES (Per Cent of 1929)											
Units											
1929	100	?	100	100	100	?	?	100	100	100	100
1931	108	100†	92.5	70	69	100†	100†	67	79.5	66	140.1
1932	120.5	108†	47	32.6	61.7	47.3†	74.5†	59	67.8	38	104.8
Dollars											
1929	100	?	100	100	100	?	?	100	100	100	100
1931	95	100†	95	119.7	187.6	100†	100†	92.5	113	54.4	88
1932	77.5	70†	58.3	61.6	110	71.6†	53.7†	57	94.5	30.4	86.4
REVERTS (Per Cent of Year's Sales)											
Units											
1929	0.6	?	?	?	?	?	?	?	3	4*	Very
1931	0.8	0.95	?	?	?	?	?	?	2.5	5.7*	small
1932	0.9	1.01	?	?	?	?	?	?	3	6.7*	
Dollars											
1929	0.1	?					?	33	6.7	?	About
1931	0.1	1.5	Approx. 1.5 per cent for				0.35	33	5.3	?	1 per
1932	0.5	2.3	period covered				0.46	16.4	6.7	?	cent
ENERGY REVENUE from Utility Sales of Merchandise (Estimated Per Cent of 1929)											
1929	100	?	100	100	100	?	?	100	100	100	100
1931	92	100†	95.5	120	53.3	100†	100†	71	86	106	117.7
1932	78	96†	58.5	61.6	110	71.3†	65.2†	74.5	85	59	113.0

MIDDLE AND SOUTH ATLANTIC — WEST

Company	2A	2B	2C	2D	2E	2F	2G	2H (*i*)	4A	4B (*m*)
MERCHANDISE SALES (Per Cent of 1929)										
Units										
1929	100	100	100	100	100*	100	?	100*	100	100
1931	95.4	89	79	155	139*	92	100†	163*	78.5	60
1932	86.3	57.1	61.8	177.8	155*	53	80.5†	195*	36	40
Dollars										
1929	100	100	100	100*	100*	100	?	100*	100	100
1931	98.8	78.1	101.0	137.5*	142*	147	100†	121*	83	?
1932	54.7	50.8	61.2	75.8*	125*	71	77†	195*	37	?
REVERTS (Per Cent of Year's Sales)										
Units										
1929	1.8	6.1	?	?	?	?*	?	?	?	1
1931	3.5	6.2	?	?	Less	?	22	?	?	2
1932	2.7	10.9	?	?	Less	?	19	?	?	10
Dollars										
1929	2.9	9.9	?	3.0	?	?	?	?	7.9	?
1931	6.6	11.5	?	7.5	Less	?	20	?	16.1	?
1932	4.9	14.2	?	17.7	Less	?	20	?	27.2	?
ENERGY REVENUE from Utility Sales of Merchandise (Estimated Per Cent of 1929)										
1929	100	100	100	100	100	100	?	100	100	?
1931	52	60.8	130	149.5	128	350	?	112	93	?
1932	32	51.1	77.3	81.5	163	166	?	147	37	?

CENTRAL

Company	3A	3B	3C	3D	3E	3F	3G	3H	3I	3J	3K	3L	3M	3N	3O	3P	3Q	3R
MERCHANDISE SALES (Per Cent of 1929)																		
Units																		
1929	100	100	100	100	100	?	100	100	100	?	100	100	?	100	?	100	100	100
1931	63.9	84.6	86.1	72.6	101.2	100†	111	62.3*	103*	100†	86.3	101.6	?	121.8	?	80	93	98
1932	29.78	55	76.9	54.3	78.1	40.97†	64.1	43*	67*	63.6†	69	44.71	?	76.84	?	60	55	70
Dollars																		
1929	100	100	100	100	100	100	100	100	100	?	100	100	100	100	100*	100	100	100
1931	59.1	73.8	94.2	64.9	84.5	100.9	118.5	86	144	100†	73.6	119.3	58.4	124.6	64.8*	80	69	163
1932	26.13	40	52.7	47.8	60.5	33.55	73.7	68	91	90†	50	63.53	16.72*	76.58	57*	60	40	95
REVERTS (Per Cent of Year's Sales)																		
Units																		
1929	?	?	.....	?	8.1	?	?	?	?	?	6	3	No data	11.79	?	5	?	?
1931	?	?	.....	?	10.5	1.32	?	?	?	?	12.3	7	but	13.07	?	7	?	?
1932	21.54	2	.....	?	12.9	2	?	?	?	?	7.8	7	5	stated	20.67	?	10	?	?
Dollars																		
1929	11.97	4	5.33	?	7.3	11.27	?	2.2	3.5	?	11	3	as	10.87	0.87	5	0.56*	?
1931	13.60	3.5	9.18	?	12.2	9.82	?	2.1	2.9	23.5	11	4	very	21.61	1.66	7	?	?
1932	32.00	4	20.62	?	13.2	20.33	?	1.5	3.7	10.3	14	6	few	17.68	1.97	10	1.4	?
ENERGY REVENUE from Utility Sales of Merchandise (Estimated Per Cent of 1929)																		
1929	?	?	?	100	100	100	100	100	100	?	100	100	?	100	?	100	100	100
1931	?	?	?	63.3	92.9	70.7	77.1	102.5*	132*	100†	85	109.3	?	117.1	?	55	92	196
1932	?	?	?	49	95.4	33.6	45.8	79*	90*	90†	68	63.76	?	82.62	?	33	55	109

(*i*) Independent operating company. (*m*) Municipal plant. ? Information not available. *See notes, with company designations. †Owing to lack of 1929 figures 1931 was taken as base (100). (*x*) Six other reports from far West were presented in the August 27 issue.

*Qualifications of Data in Table I with Company Designations

1 J—Per cent reverts based on major appliances. Reverts on minor appliances small, estimated at 0.25 per cent in 1929.

2 D—Sales in "net" dollars.

2 E—Reported merchandise sales are net sales of ranges, water heaters and refrigerators. That is, repossessions and reverts in both number of units and dollars have been deducted from gross sales.

"Our merchandise sales records are so kept that the number of units and dollars sold are net figures and that any repossessions in one month are deducted from gross sales made in that same month.

2 H—Units sold include ranges, water heaters, refrigerators, ironers, washers, cleaners and radios.

Number and value of repossessions not indicated, but small. Units repossessed in 1932 increased by 0.9 per cent; value increased 1.13 per cent.

3 H and 3 I—Energy revenue for 1931 and 1932 relates to five months ended May 31. All other data of these companies are for the full twelve months ended May 31.

3 M—Merchandise dollar sales are for 8 months of 1932. "Fall and Christmas trade will probably raise percentage materially."

3 O—Figures include appliance repairs and sales of industrial equipment as well as domestic appliances. Refrigerator sales in 1932 were double 1929. Range sales up 10 per cent in 1932 over 1929. Reverts on both are negligible.

3 Q—Reverts not available for 1929. 0.56 refers to 1930.

Table II—Cash and Installment Sales of Appliances

(In per cent for twelve months ended June 30)

Company	1A			1H	1I	1J		1K
	Instal.	30 & 60 Day	Cash	Cash	Cash	Cash*	Cash†	Cash
1929	55	33	12	10	40	10	10	9.8
1931	50	38	12	5	35	15	90	9.5
1932	55	34	11	5	25	15	90	9.8

*Major appliances. †Minor appliances.

appliances. Now those appliances—including refrigerators, ranges, water heaters, etc.—are good load builders, and the estimates of energy revenue bear out the inference. Other examples of such a change of emphasis will be found.

Reverts—It is in repossessions that the most striking differences are to be discovered. The first feature to smite the eye is the large number of "?" in this section of the table. That symbol means that information was not available.

To a company selling electrical energy the primary object of merchandising is supposed to be to build up its load. If the devices do not stay sold, or if it is unknown to what extent they stay on the lines, how can the effectiveness of its merchandising policy be gaged?

The next feature is the wide range in the percentage of reverts. Reports vary from a fraction of 1 per cent of the dollar sales in a given year to 33 per cent, excluding the preliminary reports. Whether the percentages ran higher in some of the instances for which statistics were not available is an open question. The reader can do his own guessing.

In fairness, differences of company procedure should be taken into account. Where the custom prevails of reviewing the customer's ability ultimately to pay, and of helping him accordingly to refinance his purchase, repossessions necessarily are fewer than where he is held more strictly to the terms of his contract. This point was not raised in the survey, therefore specific cases cannot be pointed out. It was featured, however, in letters accompanying some of the replies.

As might be expected, reverts increased in number and value as the customers' financial condition became more straitened. But even here exceptions are to be noted. More care was taken in extending credit in the first place, though not necessarily by radically curtailing sales. Examples of keeping the number of reverts within bounds, while maintaining a good volume of activity in merchandising, are to be found in companies 1A, 1B, 1G, 1I, 1K, 2A, 2H, 3H, 3I, 3L, 3O, 3Q, and, somewhat less effectively, in other reporting companies.

The importance of scrutinizing the customer's ability to afford the purchase of an appliance was frequently mentioned.

One company cites the following experience: During October, November and December of 1931 and January of 1932 there was in effect a plan whereby their dealers could sell electrical appliances on the basis of a small down payment with the order and the balance of the payment to commence in April. With the institution of this plan the first of October, 1931, there was a very marked increase in the volume of time-payment paper finance. Of the total amount of goods sold on time during the four months mentioned more than $125,000 was sold on the basis of spring terms.

There was naturally some concern about the question as to how many of the customers would use the equipment until the first of April and then decide not to keep it and ask the company to take it back on the basis that their equity was so small that their individual loss would be neligible.

An actual review of the experience showed that 20 per cent of the amount was paid in full in cash on April 1, and only seventeen items, amounting approximately to 2 per cent, had to be repossessed. "These figures to some extent proved the value to us in a period like this of installment sales, and to some extent proved that the amount of reverts is almost entirely dependent upon the care used in passing credit."

What about the Middle West?

The eighteen companies whose merchandising activities are reported in the Middle West section of the tabulation are in the states of Minnesota, Wisconsin, Illinois, Iowa, Indiana, Ohio, Missouri, Nebraska, South Dakota, Louisiana and Texas. Although the data from these companies do not present an exhaustive statement of the status of electrical merchandising by all of the utilities in the whole Middle West, it may be said that the number and geographic position of the states here represented does allow the data to be taken as indicative of conditions in this large territory.

Fewer electrical appliances were sold for less money in 1932 than in 1929 from Minnesota to Texas. In no case is there shown a greater volume of business either in units or in dollars for 1932. Also fewer units were sold in 1932 than in 1931, but in general the drop from 1929 to 1931, two years' time, was less than the drop in the one year from 1931 to 1932. It is significant to note that five out of the eighteen companies did a greater volume of business in units in 1931 than in 1929 and the same number of companies took in more money for merchandise in 1931. The prophets of discouragement may accept as an explanation of this difference that consumer-purchasing power suffered a rapid decline in 1932. But it is direct to the point to observe that symptoms of panic began to appear among electric utility men about the end of 1931, and it is more than probable that lessened appliance sales are the direct result of lessened selling. In 1930 and 1931 the morale of the electric utility industry was kept at a high level by the fact that this industry appeared to be escaping to a large extent the reduction in revenue affecting all other businesses. There was little disposition to curtail load development work and the result is plainly apparent in the tabulation. It cannot be said that the very abrupt drop in sales in 1932 is due primarily to anything else than selling paralysis.

Of the three companies, 3A, 3C and 3F, that show greatest increases in reverts in 1932, two operate in highly industrialized areas, and in their cases the increases of goods turned back may be explained by increased unemployment. But the other of the three companies serve a preponderantly agricultural territory and such explanation does not hold in its case. 3K and 3N, also serving intensely industrialized regions, show a different trend. The increase in reverts for "K" in 1932 is very slight, while for "N" there has been a decrease. From the facts apparent in the table that the reverts of individual companies are quite consistent among themselves it would appear that returned or repossessed merchandise is much more a factor of selling methods and

Some Comments from Companies That Supplement Tabulated Data

Company 1 H—Industrial curtailment resulted in liquidation of important manufacturing plants in 1929-30, with heavy repossession of radio sets. Company maintains no uncollectible accounts. Slow improvement in conditions now apparent. Management is "sales minded," electrical merchandise program budgeted every three months and vigorous sales activity is maintained at all times. Sales of electric ranges to suburban and farm customers of foreign descent unusually successful through long-sustained effort, continued contact before and after sales, and construction of line extensions with aid of electric range load revenue.

•

Company 1 I—Unit sales include all electrical merchandise. Many items, such as lamp shades, consume no energy, but add to annual sales revenue. Units sold fell off in 1931 and dollar sales increased; marked trend toward sale of major appliances, including washers. Little trouble from reverts at present. Repossessed refrigerators are quickly sold; no stock accumulates. Credit risks are sharply scrutinized and this policy keeps reverts low. Merchandise department functions vigorously and is valuable load-building asset.

Small number of reverts: Refrigerators, 1929, 0.35 per cent; 1931, 0.75 per cent; first half of 1932, 2.1 per cent. Vacuum cleaners, 1929, 15 per cent (high-pressure sales campaign by manufacturer); 1931, 4.7 per cent; first half 1932, 12.9 per cent. In washing machines 5 per cent is high for the period; 1.5 to 2 per cent for ranges.

•

Company 2 C—Repossessions have been much higher than formerly, but market for repossessed merchandise is much better. People have been hunting for bargains. Repossessed merchandise to be moved readily has to be marked with prices that permit of unusual value to the purchaser. "While repossessions are higher this increase accounts only in part for our decrease in net sales."

During twelve months ended June, 1929, had an all-employee campaign on percolators, with sales of 11,849 units, and one on kitchen units, with sales of 3,349. This is taken to account in part for the relatively low percentages, compared with 1929, in other years of units sold. By assuming normal 1929 sales on these two appliances the percentages for 1931 and 1932, estimated, are much higher—110 per cent and 87.5 per cent. No employee campaign in succeeding years.

•

Company 2 H—The secret of good collections is intelligent credit review before the sale is accepted. People's credit may change from year to year, sometimes, of course, quite quickly. However, the moral character of the individual is not subject to such rapid variation, and in passing credit upon a customer it is our belief that, in general, if a man's financial condition changes during the life of the contract, some slight modification in the amount or number of payments required by the installment sale can be adjusted to the mutual satisfaction of both the customer and the company, so that except in a small percentage of cases it will be unnecessary to remove the appliance or lose the revenue occasioned by its use.

The secret of collections

It has been our policy to be very aggressive in the sales of appliances. However, we feel that if this policy is to be successful, we should only sell appliances to customers who can afford to pay for them, and can afford to pay for the electricity which they use. Consequently, when we pass credit upon a customer and find that some six or eight months after the appliance has been installed he is unable to meet his payments, we take the position that perhaps we have fallen down in our service to our customer and sold him an appliance which he should not have purchased under his present economic condition. In these cases, instead of hastily taking back the appliance or putting extra pressure on the customer to pay, it is our custom to review his entire financial situation and find out if by rearranging the payments over a longer period of time, thereby making the monthly payment lower, we can put the customer in a position really to fit this payment into his family budget without serious burden. In such cases we refinance the appliance and do not consider it a revert.

•

Company 4 A—Submitted complete list of number of units of each appliance sold in each year, together with actual values of sales in dollars. The decrease has been almost as great in the number of small as in larger appliances sold. This company has had heavy sales of such equipment as ranges, refrigerators and water heaters. The following specific percentage sales in 1932 compared with 1929 show this: Ranges, 26; refrigerators, 42; water heaters, 50; vacuum cleaners, 43; washing machines, 18, ironing machines, 35; irons, 45; fans, 77.

To show the great volume of large units, in 1929 this company sold more ranges and nearly as many water heaters as flat irons: Ranges, 2,568; refrigerators, 714; water heaters, 1,640; vacuum cleaners, 468; washing machines, 1,959; ironing machines, 282; irons, 1,767; fans, 349.

•

Company S—During the early part of 1931 there was an impression that business was going to be better and with a considerable proportion of our people in fairly comfortable circumsatnces we were able to maintain our merchandising volume, there being some decrease in some items and considerable increases in others. But instead of getting better, conditions became worse and there was considerable increase in unemployment and decline in the public morale. This resulted in a larger number of reverts during 1931 than we had ever experienced before.

During the present year this condition has disappeared. For one thing our managers and sales managers have been more careful with reference to credit, and for another thing people who have not been confident that they could pay for stuff haven't bought. The result is that the reverts we have had on this year's merchandising have probably not been above normal.

In a large proportion of instances repossessed refrigerators and ranges are snapped up at reduced prices as quickly as they are taken in.

•

Company T—Unable to give information in regard to reverts, but ratio of uncollectible bills to merchandise net sales follows:

	Per Cent
One division ..... (1930)	—0.32
Whole company ..... (1931)	—1.91
Whole company ..... (1932)	—2.40

Merchandise sales of one division dropped from about $2,800,000 in 1931 to $1,534,000 in 1932.

For the past twelve months the aggregate amount of uncollectible bill expense written off is less than in the preceding twelve months period, but it represents a higher percentage of the sales volume transacted during the interval. Of course, figures kept in this form are not particularly accurate as the amount of the write-offs at any given time is not related to the volume of sales transactions at the moment or over the interval in question.

While we are checking credit very closely and without close supervision over credit feel that our losses would be unduly high, we have no particular fear that they will get out of hand with proper supervision.

•

Company U—Reverts are kept to a minimum at all times, by standardization on certain lines of merchandise and permitting offices to carry only one or two lines of various major appliances. Offices are held down to a 60- or 90-day stock turnover, keeping stock in good condition.

Very strict policies are maintained regarding approval of purchaser's credit. Down payment not less than 10 per cent on all major appliances. During past twelve months, while sales volume has been reduced about 35 per cent, have continued program of intensive merchandising activity.

Personally, I feel there is no reason for an exceedingly heavy shrinkage in merchandise sales volume at this time. If proper sales planning and effort are put forth an unusual number of reverts is unnecessary.

policies than a manifestation of impaired ability of the purchaser to pay for what he buys.

As stated in the preliminary report of this survey, published August 27, lax credit scrutiny is probably the principal cause for large numbers of reverts.

An interesting comment on reverts comes from a company in a state where utilities are prohibited by law from merchandising. "We endeavor to keep close contact with the dealer, and although we do not have any comparative figures most of the more aggressive dealers in our territory complain bitterly about the increase in reverts. In many instances I think this condition is brought about by some of the dealers relaxing on their credit policy in an effort to increase their volume." This comment lends color to the impression taken from the consistency of revert percentages in individual companies that reverts are simply and solely a matter of credit and sales policy.

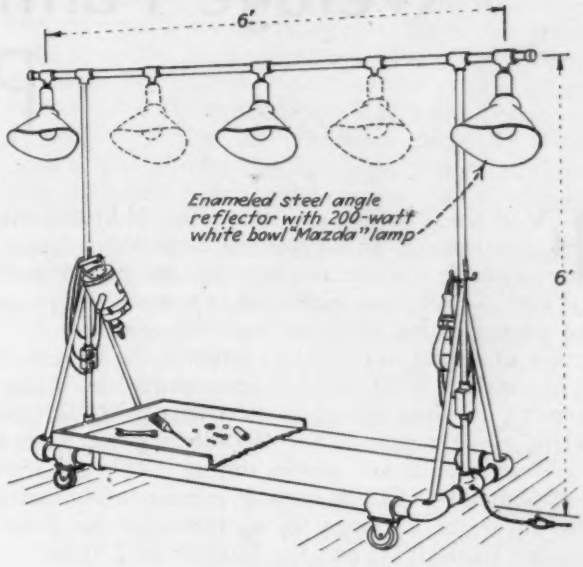
Reverts sell quickly

Another observation on reverts is interesting. "Most of the articles repossessed are resold quickly, and while the volume of sales shows quite a decrease due to the amount of merchandise returned it must be remembered that it likewise shows a considerable increase due to the resale of these used appliances and these sales might not have been made if the used goods had not been available to resell at more favorable prices. Another thing to remember is that appliance accounts, generally speaking, are in better shape than accounts for electricity. This is because we can and do repossess unpaid-for appliances and resell the merchandise to clean up the account, which cannot be done with delinquent bills for electricity."

Revenues from domestic appliance sales are not growing as fast as they did. Few companies have been inclined to rate reductions in the past three years and that cause cannot be advanced in explanation of decreased appliance energy revenues. The cause is undoubtedly decreased appliance sales. But look at companies "E," "H," "I," "J," "L" and "N." All six of these companies show up well in regard to appliance energy revenue, although four sold fewer units in 1932 than in 1931. Ranges, refrigerators and, to some extent, water heaters are the answer to this condition. Data on revenue increase or decrease were not supplied by five out of the eighteen companies. Does this mean that these five companies do not know what effect appliance selling has in building up the domestic load? And yet the reason for utility merchandising is commonly accepted to be load building.

In spite of the fact that the tabulation shows a general reduction in both unit and dollar volume of merchandising done by central stations in the Middle West, it certainly cannot be said with any truth that the domestic appliance market is all shot to pieces. The general merchandising performance in 1931 in comparison with 1929 and the records of some reporting companies for 1932 prove that the domestic appliance market will still pay good dividends on industrious and intelligent cultivation. The peculiar maintenance of revert levels in the instances of all reporting companies indicates that reverts are not a matter of present business conditions to the extent that the calamity howlers would like to have them appear. Also, the fairly high percentages shown for revenue increases from appliance selling indicates to some degree that utilities are turning now to those major appliances that are most important in actual load building.

Light for Dark Places



Any automobile mechanic, amateur or professional, who has ever yelped at his helper to put that "so and so" light where he can see something with it will probably appreciate the portable garage lighting unit recently designed by W. Sturrock, Nela Park engineering department, General Electric Company, Cleveland, Ohio. It is designed to produce shadowless illumination. The sketch shows the simple pipe-frame construction on which a number of lighting units are mounted and which carries also outlets for portable tools.

▼

Rural Electrification and the Grid

In the United Kingdom 320 authorized "undertakers" are concerned with supplying electricity in rural areas, declared R. Borlase Matthews, England, recently,* but for various reasons the farm load had been comparatively neglected.

Emphasis was laid on the fact that the future of British farming will undoubtedly lie in intensive cultivation rather than in the adoption of modern prairie methods. "Today farming is carried on too much after the fashion of a weaver with a hand loom—i.e., with antiquated methods and machinery—yet farmers in the aggregate already use more power than that employed in all the other industries combined. Hence, the suggestion is made that, in view of the existence of the grid, this power should be electric."

As the 300 ordinary uses of electricity on farms are now generally well known, brief reference was made to the new and larger farm apparatus, such as the 30-hp. rain cannon, 150-hp. hay-drying and disintegrating plants, 250-hp. electric ploughs and 80-hp. combined harvester threshers. Reference was also made to electric heating of the soil, to moving platforms for milking cows continuously, and to the auxiliary industries, such as those concerned with the manufacture of alcohol, beer, flour, starch and sugar.

**British Society of Advancement of Science.*

Average Farm Customer Pays $81.40 Annually

FOR the first time statistics collected by the national government in a decennial population census are available with reference to the use of electricity on the farm. From data published as a result of that census the accompanying table has been compiled.

Out of a total of 6,288,544 farms in the United States as of April 1, 1930, 841,333 are reported as having the farmer's dwelling lighted by electricity, 570,953 reported paying an aggregate of $46,480,436 to power companies for electric light and power during 1929, 256,656 had electric motors. On the basis of correspondence with the Bureau of the Census it is inferred that the difference between the 841,333 and the 570,953, or 270,380, represents quite closely the number of farm dwellings served by private lighting plants.

It thus appears that the number of farmers' dwellings electrically lighted was equal to 13.4 per cent of the number of farms; the number of central-station customers to 9.1 per cent, with an average bill of $81.40, and that about 45 per cent of these customers had electric motors.

This, however, somewhat understates the present status of farm electrification. The N.E.L.A. estimate of the number of farm customers at the end of 1929 is in close agreement with the census figure; the subsequent growth is indicated by the following more recent N.E.L.A. statistics, which show an increase of about 130,000 by the end of 1931, bringing the number of farms served by central stations to 11.1 per cent.

With two exceptions the average bills in the several geographical divisions fall within a narrow range, around $60 annually. The exceptions are the West South Central, $90.75, and the Pacific, $147.50. The effect of the irrigation load is particularly evident in Arizona, with an average bill of $251, and in California, $195.50.

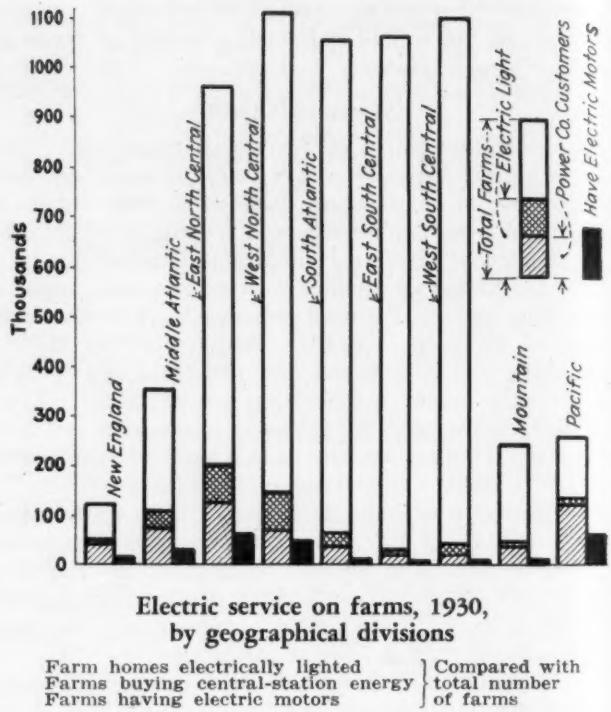
All of these greatly exceed the average bill per domestic customer, which in 1929 was estimated at $31.65; in 1931 at $34.10. The average per farm customer in most parts of the country is twice as large; in California in 1929 it was six times and in Arizona nearly eight times the national average domestic bill for the same year.

Farms Served by Central Station Companies

(N.E.L.A. Estimate)

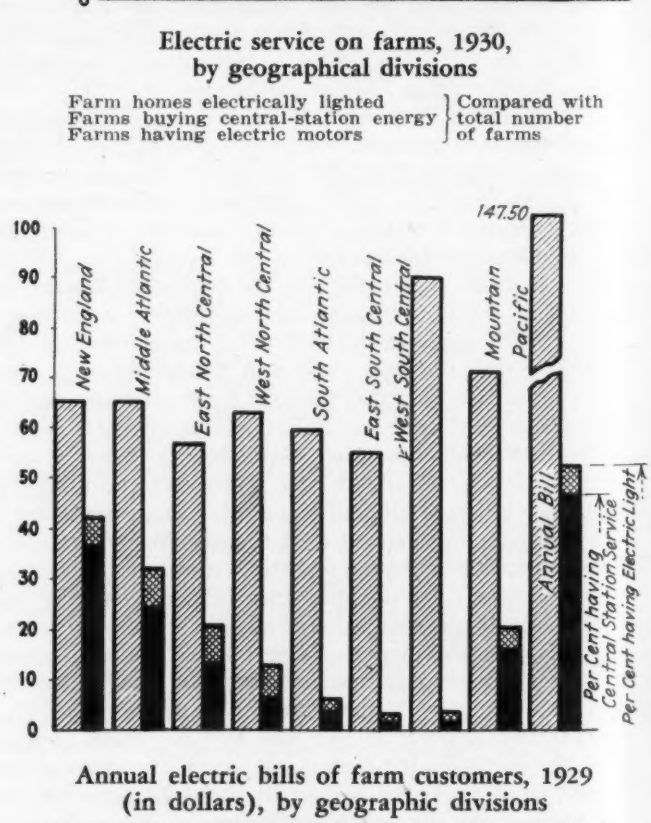
	December 31, 1931	December 31, 1930	Per Cent of Total	
			1931 (N.E.L.A.)	1929 (Census)
Geographic Division				
New England	52,237	48,996	41.9	36.4
Middle Atlantic	104,911	96,342	29.4	24.5
East North Central	166,893	151,113	17.3	13.4
West North Central	89,717	82,283	8.0	6.5
South Atlantic	47,958	42,539	4.5	3.5
East South Central	31,513	29,949	3.0	1.8
West South Central	22,170	21,438	2.0	1.7
Mountain	44,308	42,536	18.4	16.2
Pacific	139,079	134,723	53.2	47.0
United States	698,786	649,919	11.1	9.1

One farm in nine has electric light; few have motors



Electric service on farms, 1930, by geographical divisions

Farm homes electrically lighted
Farms buying central-station energy } Compared with total number of farms
Farms having electric motors



Annual electric bills of farm customers, 1929 (in dollars), by geographic divisions

Also number having electric light and number of central-station customers in per cent of total.

Maximum electrification, in proportion to the whole number of farms, is found in New England and on the Coast; minimum in the South, where the state-wide average in only a few instances rises as high as 4.0 per cent. The only states having as many as 50 per cent of their farms served by power companies are California and Massachusetts. In using these figures as a measure of potential business the wide diversity of agricultural conditions must not be overlooked.

Individual home-lighting plants, assuming that these make up the difference between homes electrically lighted and number reported paying electric bills, are quite numerous throughout the entire Middle West, especially in the northern half. There are about as many as there are farms on central-station service. This is the great grain belt; farms are large; dwellings are far apart; distribution costs for central-station service would often be prohibitive; the individual plant is in many instances the only solution if the convenience of electricity is to be enjoyed at all. Throughout this area, though, electric light from any source—individual plant or central station—remains the exception.

The application of electric power on any considerable scale is still to be made. Electric motors are used on only one farm in twenty-five. Two-thirds of the farms in any degree motorized are in the North Central and Pacific States. The stationary gas engine is by far the predominant form of mechanical power. In most states it is used on at least three times as many farms as electric motors; in some the ratio is much higher; six to one is not unusual.

Meanwhile the pioneer work that had been done toward increasing the use of electricity on the farm is bearing fruit. The 7.5 per cent gain in number of farm customers during 1931 was proportionately much greater than in any other group. The hindrances to this growth lie, of course, primarily in the heavy investment required per customer. Such a condition can only improve with the load density along a given circuit. This first collection of nation-wide data will help, by affording a basis for estimating the prospective income.

The tabulation is here given by states. From the reports issued by the Bureau of the Census under the designation "Agriculture, Statistics by Counties, Second Series" similar information can be worked out for every county.

Electric Service on Farms

(From U. S. Census of 1930)

State	No. of Farms	No. Reporting Elec. Lt.	No. Reporting Elec. Motors	Elec. Bills Paid in 1929		Average Bill, Dollars	Elec. Lighted, Per Cent	Customers,* Per Cent	Lighted,† Not Purchasing
				No. Reporting	Amount, Dollars				
Maine	39,006	12,920	3,447	10,938	498,169	45.60	33.1	28.0	1,982
New H'shire	14,906	6,160	1,561	5,014	306,648	61.20	41.2	33.7	1,146
Vermont	24,898	7,565	2,358	6,403	331,008	51.75	30.3	25.7	1,162
Massachusetts	25,598	16,037	4,266	13,821	1,051,305	76.00	62.6	54.0	2,216
Rhode Island	3,322	1,910	646	1,671	153,011	95.20	57.5	50.3	239
Connecticut	17,195	9,063	2,514	7,675	645,337	84.10	52.7	44.6	1,388
New England	124,925	53,655	14,792	45,522	2,985,478	65.50	42.8	36.4	8,133
New York	159,806	55,019	16,012	43,350	2,769,649	63.80	34.4	27.1	11,669
New Jersey	25,378	13,441	4,102	10,968	920,335	83.90	52.8	43.2	2,473
Pennsylvania	172,419	45,638	12,197	33,215	2,045,427	61.50	26.4	19.3	12,423
Mid. Atlantic	357,603	114,098	32,311	87,533	5,735,011	65.60	31.9	24.5	26,565
Ohio	219,296	56,740	14,000	37,695	1,930,282	51.20	25.9	17.2	19,045
Indiana	181,570	30,335	7,795	18,569	908,296	48.90	16.7	10.2	11,766
Illinois	214,497	34,321	10,452	18,317	1,191,792	65.00	16.0	8.6	16,004
Michigan	169,372	34,785	10,285	24,233	1,251,834	51.60	20.5	14.3	10,552
Wisconsin	181,767	46,565	22,812	30,233	2,089,534	69.20	25.6	16.6	16,332
E. No. Cent.	966,502	202,746	65,344	129,047	7,371,738	57.20	20.9	13.3	73,699
Minnesota	185,255	23,342	11,721	12,413	855,425	68.90	12.6	6.7	10,929
Iowa	214,928	46,042	17,277	25,149	1,626,563	64.50	21.4	11.7	20,893
Missouri	255,940	20,223	3,580	12,486	602,387	48.20	8.0	4.9	7,737
North Dakota	77,975	6,192	3,203	1,721	149,581	86.90	7.9	2.2	4,471
South Dakota	83,157	9,070	3,283	2,534	182,145	71.90	10.9	3.0	6,536
Nebraska	129,458	21,380	5,807	7,485	558,545	74.60	16.5	5.8	13,895
Kansas	166,042	20,720	5,101	10,305	594,177	57.70	12.5	6.2	10,415
W. No. Cent.	1,112,755	146,969	49,972	72,093	4,568,823	63.20	13.2	6.5	74,876
Delaware	9,707	1,561	384	1,027	89,315	87.00	16.1	10.5	534
Maryland	43,203	9,145	2,557	6,226	445,723	71.60	21.2	14.4	2,919
Virginia	170,610	13,009	2,427	7,730	469,524	60.70	7.6	4.5	5,279
West Virginia	82,641	5,330	884	2,844	154,305	54.20	6.4	3.4	2,486
No. Carolina	279,708	15,006	1,633	8,774	403,120	45.90	5.4	3.1	6,232
So. Carolina	157,931	6,067	757	3,039	145,105	47.75	3.8	1.9	3,028
Georgia	255,598	7,499	968	3,591	206,932	57.70	2.9	1.4	3,908
Florida	58,966	6,489	1,592	4,131	324,052	78.30	11.0	7.0	2,358
So. Atlantic	1,058,364	64,106	11,202	37,362	2,238,076	59.90	6.0	3.5	26,744
Kentucky	246,499	10,691	1,121	5,863	323,152	55.20	4.3	2.4	4,828
Tennessee	245,657	10,010	1,216	6,720	336,965	50.10	4.0	2.7	3,290
Alabama	257,395	6,459	678	3,839	196,455	51.00	2.5	1.5	2,620
Mississippi	312,663	4,792	494	2,354	174,404	74.10	1.5	0.7	2,438
E. So. Cent.	1,062,214	31,952	3,509	18,776	1,030,976	55.00	3.0	1.8	13,176
Arkansas	242,334	5,121	1,056	2,689	309,610	115.00	2.1	1.1	2,432
Louisiana	161,445	4,174	510	1,949	240,926	123.50	2.6	1.2	2,225
Oklahoma	203,866	8,091	1,688	3,942	267,710	67.75	3.9	1.9	4,149
Texas	495,489	22,854	4,051	9,954	861,661	86.55	4.6	2.0	12,900
W. So. Cent.	1,103,134	40,240	7,305	18,534	1,679,907	90.75	3.6	1.7	21,706
Montana	47,495	3,547	1,088	1,983	158,207	79.75	7.4	4.2	1,564
Idaho	41,674	12,809	4,406	10,731	670,828	62.60	30.8	25.7	2,078
Wyoming	16,011	1,145	315	454	46,816	103.00	7.2	2.8	691
Colorado	59,956	9,393	2,289	6,548	422,961	64.60	15.6	10.9	2,845
New Mexico	31,404	1,691	393	1,102	117,337	106.20	5.4	3.5	589
Arizona	14,173	3,671	1,427	3,070	772,854	251.00	25.9	21.7	601
Utah	27,159	15,778	1,269	14,462	543,840	37.60	58.1	53.3	1,316
Nevada	3,442	1,139	564	810	56,318	69.50	32.9	23.5	329
Mountain	241,314	49,173	11,751	39,160	2,789,161	71.40	20.4	16.3	10,013
Washington	70,904	34,056	10,751	29,070	1,845,763	63.50	48.0	41.0	4,986
Oregon	55,153	18,397	6,043	14,991	796,462	53.20	33.4	27.2	3,406
California	135,676	85,941	43,676	78,865	15,439,041	195.50	63.3	58.2	7,076
Pacific	261,733	138,394	60,470	122,926	18,081,266	147.50	52.7	47.0	15,468
U. S.	6,288,544	841,333	256,656	570,953	46,480,436	81.40	13.4	9.1	270,380

* Customers paying for central-station service compared with number of farms.

† Difference between number having electric light and number reporting payments for electric service, assumed to be the number lighted from individual plants.

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Residence Cooling With Ice

Ice for residence cooling was studied during the past summer by the Detroit Edison Company by means of an experimental installation in a Birmingham, Mich., home. This installation, which cooled a space of 17,000 cu.ft., consists of a 500-gal. fuel oil tank holding 1 ton of ice and buried in the yard, with ice cold water pumped from it through a cooling surface in the duct of a forced circulation warm air heating system. The maximum cooling load is 4 tons of refrigeration and the cost of the equipment was $800. Its operation was reported by S. S. Sanford at a recent meeting of the Great Lakes Power Club as follows:

"Cold city water was used in the cooling surface during June. During June the system was used seven days and the equivalent ice consumption would have been 2 tons. In July and August 7 tons of ice were used, making a total of 9 tons for June, July and August. The system was used fifteen days during July and August. The maximum amount of ice used during one day was 2,500 lb. On this day the indoor temperature was purposely held at 76 deg. for 24 hours while the outside temperature went to 95 deg. This test showed the possibilities of the cooling system, but does not represent ordinary operating conditions. In regular operation the indoor temperature would not be held so low on a hot day and the ice consumption would therefore be less."

Flywheel Equalization of Fluctuating Loads

By T. R. RHEA
Industrial Engineer Department,
General Electric Company

Some common applications of flywheels to motor drives.
Three methods of control.
Size of flywheels and motor speed characteristics.
Relative efficiencies and cost.

A ROTATING flywheel, being a reservoir of energy, is very useful in equalizing the load on a motor applied to drive a fluctuating load. It reduces the peak power demands on the power system and allows the motor to draw a more uniform input. This becomes important where the power is purchased and the peak loads are penalized and also where the power system is small and unable, physically, to stand the peak loads. The combination of a flywheel and a wound-rotor induction motor permits a motor of smaller horsepower rating to be applied to a given fluctuating load than if the flywheel were not used. However, the over-all cost of the flywheel, motor and control will slightly exceed, in most cases, the over-all cost of a straight motor without flywheel even though the omission of the flywheel necessitates a motor of higher horsepower rating.

There are exceptions, of course, and these will be discussed. But where the power system is amply large and no peak demand penalty is encountered the use of a synchronous motor big enough to take the peak load, and its control, will usually be less expensive and certainly simpler than the flywheel and wound-rotor induction motor set with its primary and secondary control.

To give up energy or to produce torque, a flywheel must slow down. Therefore, the speed characteristics of a motor used in combination with a flywheel must droop with load.

For larger drives the most commonly applied motor is the wound-rotor induction motor with external resistance inserted in the secondary to give 10 to 15 per cent speed drop at full load. A compound-wound direct-current motor also provides the necessary characteristics of drooping speed with load, but is rarely used in combination with a flywheel because of the higher cost of the d.c. motor and its necessary conversion equipment over the wound-rotor induction motor taking power directly from the a.c. power lines. Squirrel-cage induction motors with high-resistance rotors to give the necessary speed drop with load are often used in combination with flywheels in smaller sizes.

Where flywheels are used

Mine Hoists—The hoisting of ore or coal from a mine requires a periodic peak load on the hoisting motor with intervals of rest and light load. Since the hoisting motor itself must start, stop and reverse in operation the use of a flywheel on the motor itself is prohibited. Consequently the mine hoist motor is usually a direct-current motor without flywheel and supplied with direct-current power from a motor-generator set. The control of the mine hoist motor speed is by variable armature voltage.

When we come to the motor-generator set supplying this mine hoist motor the flywheel becomes applicable. This motor-generator set is frequently located out at the end of a relatively long transmission line and sup-

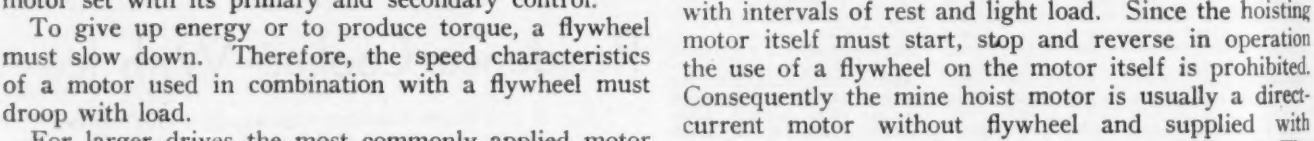

Fig. 1—Flywheel motor-generator sets smooth out power demands of hoists and reversing mills
4,400-kw., 514-r.p.m. motor-generator set with 140,000-hp.-second flywheel at A. M. Byers plant, Economy, Pa.

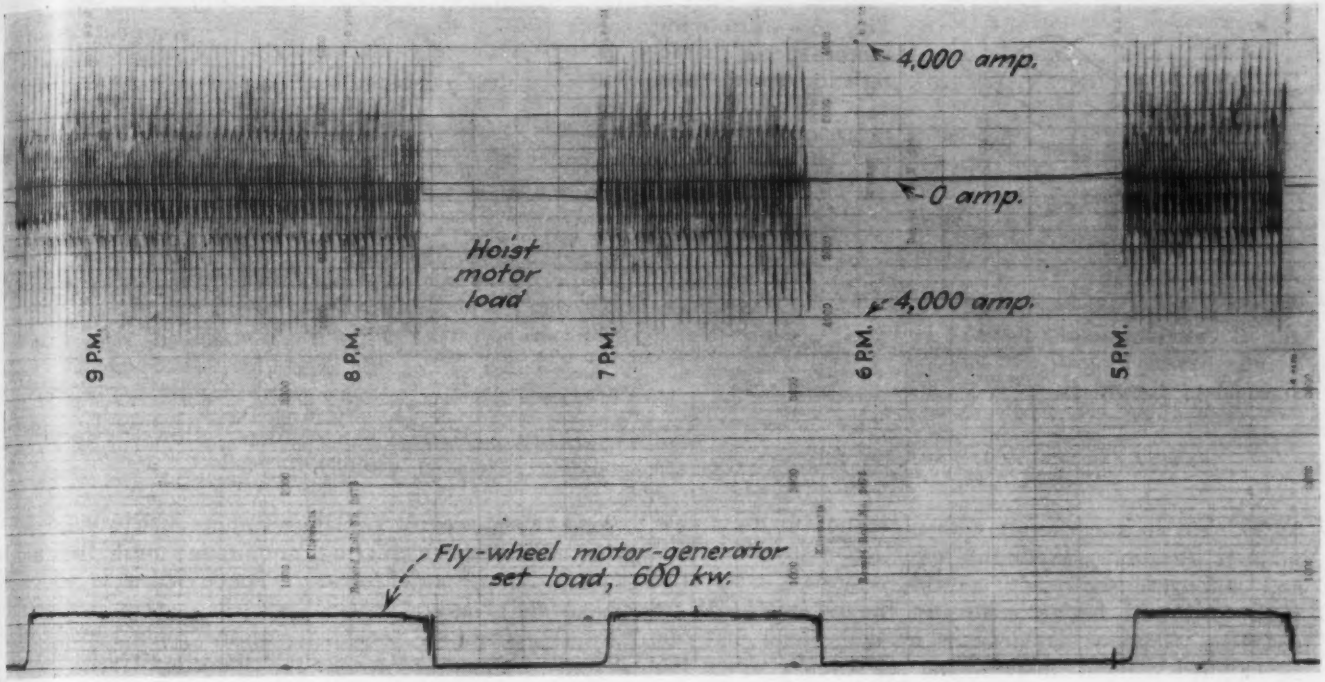

Fig. 2—Corresponding loads on hoist and flywheel motor-generator set

1,400-hp. hoist motor; 1,100-hp. motor-generator

plied with a.c. power from a system which may be none too large. Here a flywheel becomes really useful in smoothing out the power demands of the hoisting motor and passing them on to the a.c. power system in the form of a more uniform power flow.

Steel Mills—On certain main roll drives, where a piece of hot metal is passed through the rolls and subjected to heavy reduction and when a long interval then ensues before another piece is entered, considerable reduction in the necessary motor rating is obtainable by use of the flywheel and wound-rotor induction motor combination. On the roughing end of a continuous mill the duration of the pass and load may be of the order of two seconds and perhaps 2,000 hp. with a no-load interval of, say, 20 seconds, with a 50-hp. friction load. A reasonable combination for such a mill drive would consist of a 500-hp. wound-rotor induction motor with a secondary resistance of 10 per cent (i.e. speed drops 10 per cent with full load) and a 10,000 hp.-second flywheel. With this combination the peak load on the power system would be 850 hp., or 169 per cent load on the motor.

On the other hand, if a synchronous motor were applied it would require at least a 1,000-hp. motor and its peak load would, of course, be 2,000 hp.

Neither motor would approach its rating as far as heating is concerned. The ratings in each case are chosen with reference to the peak loads and indicate conservative practice for the two types of drives. In this example and in these applications in general where the peak load is high, exists for only a short time and the rest period is relatively long, the first cost of the induction motor, its control and the flywheel will be somewhat less than for the synchronous motor and its control without the flywheel.

It has been found by experience that if the load lasts more than three or four seconds a synchronous motor drive will be cheaper, over all.

In operating a reversing blooming mill, where the heavy cast ingots are rolled down to blooms, another co-related application of the flywheel is found useful. As in the mine-hoist equipment, the mill itself is operated by a direct-current reversing motor and the flywheel effect is kept as small as possible, since the motor must start, stop and reverse fifteen or twenty times per minute. This motor will be supplied, by means of generator voltage control, with direct-current power from a motor-generator set receiving power from the a.c. system. A flywheel is useful on this motor-generator set to reduce the peaks on the a.c. system if the size of the a.c. system demands it.

However, the first cost of the flywheel, wound-rotor induction motor drive and the necessary control will be found to be more expensive than a straight synchronous motor-driven set with its switchgear and control, even though the synchronous motor would have to be a machine of larger horsepower rating. The only justification for a flywheel set on such an application, then, is consideration for the power system and not first cost.

A very common blooming mill drive has a 7,000-hp. reversing motor, supplied with d.c. power from a motor-generator set having a 5,000-hp., 250 per cent maximum torque, wound-rotor motor with a 100,000-hp.-second flywheel. When a synchronous motor is used for driving the set its rating for the same duty is of the order of 7,000 hp. with 250 to 300 per cent maximum pull-out torque.

With the blooming mill type of load, where the length of load period is one to three seconds and the no-load period is two or three seconds, the difference in motor size required with and without flywheel is not so marked as in the case previously mentioned of main roll drive with flywheel where the load period is one-tenth the light-load period.

In the case of the synchronous motor drive the power peaks reflected into the a.c. system may reach 14,000 or

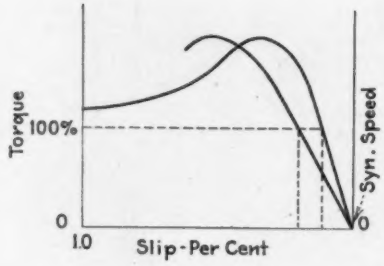

Fig. 3 — Drooping motor speed characteristic needed with flywheel

Effect of two values of secondary resistance on speed-torque curves. Amount of droop proportional to secondary resistance.

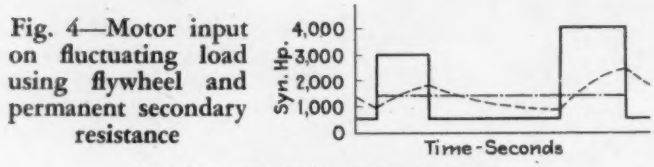

Fig. 4—Motor input on fluctuating load using flywheel and permanent secondary resistance

solid line, total load; dotted line, portion of load taken by motor.

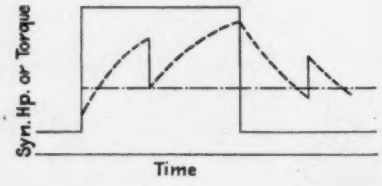

Fig. 5—Notch-back secondary control

Overload automatically inserts resistance to increase slip and release flywheel energy when motor load (dotted) reaches predetermined value.

Regulator automatically inserts resistance when load on motor reaches predetermined value. This value of motor load (hp.) is then held constant.

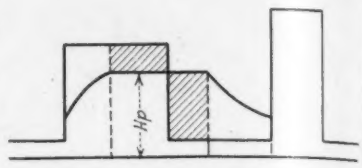

Fig. 6—Liquid slip regulator allows flywheel to absorb peaks

15,000 hp. at intervals of a few seconds up to a few minutes duration. With the induction motor, flywheel and automatic secondary control, described later, the peak load will be automatically limited to 5,000 or 6,000 hp. The setting depends upon the load that can be handled without allowing the set to slow down too much. A 15 per cent maximum drop in speed is considered good practice.

Punch Presses and Machine Tools—Punch press machines and allied machine tools have a relatively high peak load of short duration and relatively long light-load period. The usual arrangement consists of a high-slip squirrel-cage induction motor and flywheel. The motor and flywheel run continuously and the punch press is started and stopped by means of a clutch. The motor sizes run from 2 to 100 hp. and possibly a little higher. The high-slip, high-resistance, squirrel-cage induction motor is used rather than the wound-rotor induction motor with external resistance because the squirrel cage is very much less expensive and has simpler control.

The flywheel and motor ratings for various size punch presses and similar machine tools are largely selected on the basis of experience.

For a long time a certain punch press manufacturer built presses with flywheels in the usual manner, but then through a pardonable lack of understanding of induction motor characteristics applied low-resistance, low-slip induction motors, that would not slow down much under load. Consequently, when loads were suddenly applied the motor took practically the entire load, and the flywheel, not being able to slow down and give up energy, took very little. The punch press manufacturer subsequently applied high-slip, high-resistance squirrel-cage induction motors and was enabled to reduce the horsepower rating required for the particular presses from one-half to one-third of their former values.

This gives a good indication of the value of a flywheel in reducing the peak loads and ratings of motor required for these applications.

Reciprocating Compressors — Reciprocating compressors are usually driven by synchronous motors. Contrary to the general impression, flywheels are sometimes used with synchronous motors, though not for the purpose of storing up energy to be released during peak loads. The load on a reciprocating compressor is of a pulsating nature. Even a very light pulsating torque of correct frequency applied to a synchronous motor will cause the motor to oscillate about its synchronous position with ever-increasing amplitude until the motor breaks out of synchronism. The flywheel is added to make the "natural period" of the system sufficiently different from the periodicity of the applied load-torque impulses and thus prevent the "hunting" from increasing in amplitude.

A mechanical analogy of this phenomenon is obtained by suspending a weight from a spring. Depending upon the spring constant and mass, if the finger gives it a jog just at the right time, the amplitude of the oscillations will increase and may break the spring. If the weight is changed and the rate of impulses applied the large oscillations do not occur. This is what happens when the flywheel is added to the synchronous motors.

Methods of control

Since nearly all of the large and important flywheel applications are in combination with wound-rotor induction motors the control features for this type of motor should be considered. A wound-rotor induction motor with its slip rings short circuited will have a full-load slip of 1 or 2 per cent. In combination with a flywheel, then, very little flywheel energy would be transferred with a fluctuating load. The more resistance inserted the more slip or speed drop for a given load (Fig. 3.)

The simplest form of control consists of inserting permanently a secondary resistance. With sufficient secondary resistance to give 10 per cent slip at full load the input to the induction motor for a specific applied load is modified as shown by the dotted curve, Fig. 4.

Another system involves two steps of secondary resistance, the so-called "notch-back" secondary control (Fig. 5). This form of control includes a permanent secondary section of resistance of about 7 per cent so as to utilize the motor capacity as efficiently as possible on light loads or loads of short duration. When the motor load reaches a predetermined value, say 150 per cent of its rating, a current relay operates and cuts in a second block of resistance of 7 or 8 per cent, and thus allows the motor to slow down still more on the heavy long-duration loads and take more energy from the flywheel.

These two methods of secondary control are generally employed on the main-roll induction-motor flywheel drives in steel mills.

Both of these methods are but approximations to com-

plete equalization or smoothing out of the load. The "slip regulator" form of secondary control permits complete equalization for a given load cycle and flywheel size. For example, given a certain counterweight, when the motor input reaches, say, 100 per cent, the torque motor begins to lift the electrodes and increase the secondary resistance so as to hold 100 per cent input, causing the induction motor to slow down and let the flywheel take the remainder of the load (Fig. 6). With a sudden load applied the input builds up with whatever permanent secondary resistance is present, until the slip regulator setting is reached. At this point the slip regulator begins to separate the electrodes so as to keep constant load on the motor.

The slip regulator form of control is always used on induction-motor-driven flywheel motor-generator sets for supplying power to d.c. reversing blooming mill motors and to d.c. reversing mine hoist motors because it is the only form of control that makes the equalization sufficiently complete to make it worth while.

Theoretical considerations

What determines the size of flywheel (i.e., stored energy) and size of induction motor for a given duty cycle? There are two main considerations, the permissible drop in speed of the motor and the permissible peak load on the motor or power system.

If the induction motor drives a d.c. generator a maximum drop in speed of 15 per cent is permissible without penalizing the d.c. generator design too much. Suppose, then, the hypothetical duty cycle shown in Fig. 7 is indefinitely repeated and that the load has to be completely equalized. Then the load on the induction motor will be the average load of 1,710 hp. If the load is completely equalized the flywheel is just up to speed at the beginning of the first peak. At the end of the first peak the flywheel has given up 3,870 hp.-seconds* of energy. Before the beginning of the next peak the wheel has regained 3,420 hp.-seconds, leaving it with a deficiency of 450 hp.-seconds. By the end of the second peak it has fallen in arrears an additional 11,450 hp.-seconds, making a total deficiency of 11,900 hp.-seconds. It then gains 10,250 hp.-seconds, loses 5,150 hp.-seconds and gains 6,800 hp.-seconds, which makes it even and ready for the next cycle.

Thus the maximum energy which the wheel is required to give up is 11,900 hp.-seconds with a drop in speed down to 85 per cent. The flywheel must have a stored energy at top speed of:

$$E = \frac{11{,}900}{1 - (0.85)^2} = 43{,}000 \text{ hp.-seconds.}$$

Whether or not this would prove a practical size of flywheel to manufacture would depend upon the motor speed. If the flywheel should prove too large for practical bearings, castings and steel plate sections available there would be nothing to do except be satisfied with something less than full equalization and use a smaller flywheel and more motor. For example, it might be necessary to use a 2,000-hp. motor, with the slip-regulator setting limiting the peak to this value, instead of

For simplicity, the terms synchronous hp.-seconds and the stretching out of the time axis due to motor slowing down are neglected.

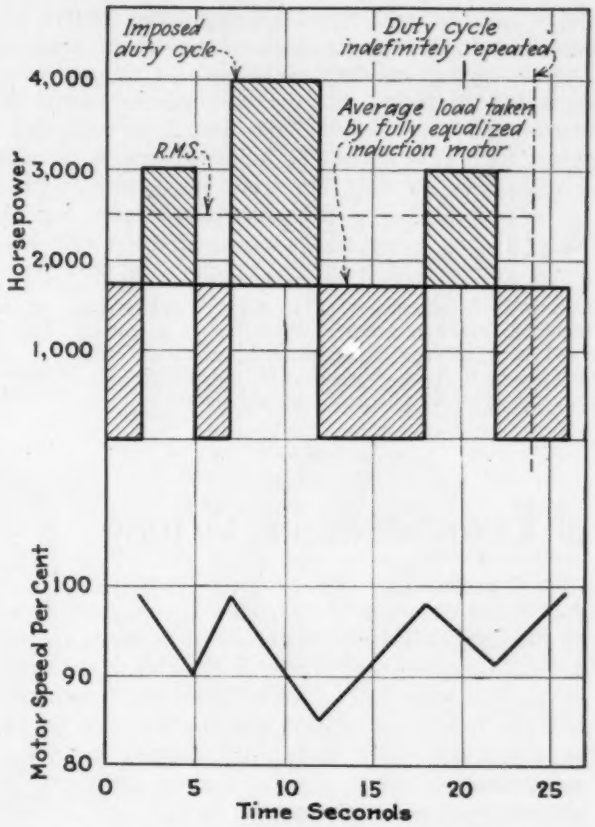

Fig. 7—Fully equalized duty cycle with flywheel and slip regulator

Analysis for determining flywheel rating and desired motor speed characteristic.

a 1,750-hp. motor with the slip-regulator setting at 1,710 hp. and complete equalization.

Incomplete equalization would mean that the load on the motor would drop down to perhaps zero in some of the longer idle periods and higher peaks could be absorbed.

In the case of complete load equalization with a flywheel the wound-rotor induction motor would be rated approximately 1,750 hp. For the same duty cycle a synchronous or induction motor without flywheel would have to be rated approximately 2,500 hp. to take care of the r.m.s. load. The peak reflected in the a.c. power system would be 4,000 hp. In this example no margin of safety has been allowed.

Comparing the efficiencies of the two motors will show the synchronous motor with an average efficiency around 94 per cent and the induction-motor flywheel combination with an average efficiency of about 87.5 per cent. Average efficiency is here defined as the average energy going to the d.c. generators divided by average energy input to the motor for the duty cycle given.

A comparison of mine-hoist set efficiencies in terms of foot-pound of work done in hoisting the net load and kilowatt-hour input to the motor will show perhaps 45 per cent for wound-rotor induction motor with flywheel and 52 per cent for synchronous-motor-driven sets. These figures are, of course, very much influenced by the nature of the duty cycle.

It is dangerous to make any general statement concerning the relative cost of the equipment with and without flywheel, but when the induction motor with the

necessary flywheel and liquid slip-regulator control are compared with the synchronous-motor-driven set and its control for a given duty cycle, such as the one cited above, it will be found that the synchronous motor arrangement will have a 4 or 5 per cent price advantage. However, each case should be analyzed and a decision made on its own merits. The trend on both mine hoist and reversing blooming mill motor-generator sets is definitely toward synchronous-motor-driven sets where the power system is stiff enough to stand the peaks.

Bibliography—"Interaction of Flywheels and Motors When Driving Roll Trains by Industrial Motors," F. C. Gasche, Transactions A.I.E.E., 1910; "Flywheels for Steel Mill Drives," L. A. Umansky, G.E. Review, October, 1923; "Determination of Motor Capacity for Main Roll Drives," H. A. Winne, A. I. & S. E. E., June, 1932.

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Real Economies in Wiring

Real economies in electrical wiring are more likely to be found in the design of the system of wiring employed than in the actual choice of materials to be used, according to Allan Coggeshall of Hatzel & Buehler, New York. "If we can find ways and means of more nearly bringing into line the capacity provided and the loads to be experienced and still at the same time preserve the necessary safeguards of spare capacity, voltage drop, protection against overload, continuity of service, etc., we will be making constructive progress. We can't feel any very great pride in a system that employs five times the material necessary to handle the load. It's the equivalent of building a roadway capable of handling more traffic than can ever be experienced and just isn't the ideal engineering, which should aim at the efficient use of the materials employed. It seems to me that the best hope for progress lies in the direction of continued joint study of customer problems by utility and contractor engineers."

With respect to the various wiring methods now employed, or to be employed in the future, Mr. Coggeshall suggests the adoption by the industry of the following principles:

1. As a general principle, it is agreed that standardization and simplification of wiring methods is desirable.
2. It must be borne in mind, however, that in following the principle laid down in the above paragraphs the way must not be closed to rational improvement in the art. Therefore, any improvement which tends to lower the cost of installation of wiring systems without sacrificing safety or usefulness is desirable.
3. An orderly procedure for full and fair consideration of new wiring systems should be open to all applicants without restriction. It is recognized, however, as a fair principle that some inertia to new methods is a healthy and proper deterrent to clogging the market with unnecessary and undeveloped conceptions.
4. In general, the industry wishes to promote the advantages of a "pull-in and pull-out" system of wiring, recognizing, however, that flexible cable extensions or moldings or other assemblies as adjuncts to such systems may be very proper where fishing operations or surface extensions are appropriate and offer the most economical method of installation.
5. The type of wiring system and the kind of material employed in any given installation should take all the factors into consideration.
6. Rules and restrictions calculated to regulate the manner of installation of various wiring systems should be developed and applied with discretion and common sense by the inspection authorities having jurisdiction in the light of sympathetic cooperation with other branches of the industry.

READERS' FORUM

Suggests Insurance Against Inability to Fulfill Time Payments

To the Editor of the ELECTRICAL WORLD:

"Sure, we want an electrical refrigerator, but ——," and this is the beginning of sales resistance. There is little doubt that present conditions have caused people generally to assume a more conservative buying viewpoint. It is apparent that the change of attitude of today's buying public is caused mainly because of the increased recognition of the possibility of impaired earning power due to forces outside of the control of either the prospective purchaser or his employer. It seems that the cause of the above decreased confidence of the buyer in his future suggests an opportunity which has been overlooked by the electrical and automotive industries, as well as numerous others including the corporations sponsoring home ownership.

The insurance companies provide protection against varied losses and recently we have heard much regarding unemployment insurance. If the insurance idea could be carried further, so as to insure the buyer of articles on the partial-payment plan against total loss of investment in case of unemployment or greatly impaired earning power, it would seem that this reduced confidence of the buyer could be greatly restored.

Even under normal conditions cash sales of electrical refrigerators, automobiles and more especially homes are the exception. Is it not cause for thought to see a man lose his entire equity in his home because of unemployment, after having sacrificed for several years to meet monthly payments? It would not be difficult for any one to cite many recent examples of this. But it would be difficult justly to charge the blame for this loss to the purchaser, to his employer or to the party holding the contract.

If these monthly payments were increased by a small amount for insurance to protect the purchaser against total loss in case of unemployment, would it not be easier for persons to have sufficient confidence in their futures to fulfill their desires immediately for new electric refrigerators, electric stoves, automobiles, homes, etc.? A clause in the purchase agreement could state that in event of default of payments caused by reduced earning power of a specified degree, for a definite period of time, that the purchaser would be refunded a fixed per cent of his accumulated net payments. This would permit an individual to make a contract for the purchase on the monthly payment plan with the knowledge that he is assured of a fixed refund even though reduced earning power should prevent the completion of payments.

If this suggested plan would help to remove only a degree of uncertainty from the mind of potential purchasers, it would seem that the increased confidence provided by it would assist greatly in shortening the time necessary for general economic recovery. Such a plan suitable to abnormal conditions might also be adjusted to extend a service under normal economic conditions.

J. L. CISSELL.

South Bend Current Controller Company,
South Bend, Ind.

Men of the Industry

FRANK W. SMITH, president of the New York Edison Company and the United Electric Light & Power Company, has been elected a member of the board of trustees of the Consolidated Gas Company of New York.

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COL. HUGH L. COOPER, who has been engaged in engineering projects in Russia for the last ten years and who, for his work as chief consultant in the hydro-electric station at Dnieprostroy, was decorated by the Soviet government with the Order of the Red Banner, returned recently to the United States.

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F. M. STARR of the central-station engineering department of the General Electric Company at Schenectady has been awarded the Alfred Noble prize for his paper "Equivalent Circuits," presented at the winter convention of the American Institute of Electrical Engineers in New York City last January. The prize, which is an award of $500, was established in 1929 in memory of Alfred Noble, prominent civil engineer. Mr. Starr was graduated from the University of Colorado in 1928 with the degree of B.S. in E.E. He entered the testing department of the General Electric Company in the same year and in the following year was transferred to the engineering general department. Two years ago he entered the distribution systems section of the central-station engineering department.

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ASHTON B. COLLINS has been appointed field representative of the National Electric Cookery Council, a unit of the National Sales Section, National Electric Light Association. Mr. Collins has had a broad background of experience in commercial and sales work. He was made merchandise manager of the Alabama Power Company in 1925, subsequently becoming commercial manager, and during the five years he was connected with the utility it became nationally known for its aggressive merchandising policy, particularly on electric ranges and water heaters. Early in 1926 he was elected president of the Alabama Electrical League and it was under his auspices that the first Alabama Electrical Exposition was held in Birmingham that same year. Later he was appointed merchandise adviser of the southern companies of the Commonwealth & Southern Corporation. Mr. Collins has served as chairman of the trade relations committee of the Southeastern Division of N.E.L.A. and as chairman of the national domestic electric range committee.

Symonds and Stephens Assume New Duties With Westinghouse

N. G. Symonds, who has been elected vice-president in charge of sales of the Westinghouse Electric & Manufacturing Company (ELECTRICAL WORLD, November 5, 1932, page 639), is one of the best-known commercial officials in the Middle West. His experience with the Westinghouse company covers the entire United States, although since 1905 he has been closely associated with the Chicago office, serving as northwest district manager and more recently as commercial vice-president. Starting with Westinghouse, Church, Kerr & Company, he spent three years in New York before he was sent to East Pittsburgh as assistant engineer of the Westinghouse Machine Company's stoker department. In 1905 he removed to Chicago.

N. G. Symonds

C. E. Stephens

In 1915, when the Westinghouse Machine Company was absorbed by the Westinghouse Electric & Manufacturing Company, Mr. Symonds was appoined manager of the power division of the Chicago office. Three years later he was made manager of the industrial division in the same office and in 1921 was appointed Chicago district manager. He was elected commercial vice-president of the company in 1930.

C. E. Stephens, who also was elected a vice-president of the Westinghouse Electric & Manufacturing Company, has had a wide experience in the electrical industry since entering the Westinghouse organization in 1900. In East Pittsburgh he became an apprentice and gained practical experience in electrical manufacturing operations, which he supplemented with technical study. He sought for and obtained extensive training in shop operations, then entered the engineering department, finally being promoted to the position of illuminating engineer. He entered sales work, was made manager of the illumination section of the sales department and afterward was transferred to New York as a division manager. In 1925 he was made manager of the New York district, when the New York territory was expanded, Mr. Stephens being appointed eastern district manager. In 1930 he was elected commercial vice-president.

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MAJOR-GEN. WILLIAM L. SIBERT, who was one of Major-Gen. George W. Goethals' chief assistants in the building of the Panama Canal, has resigned as chairman of the Colorado Advisory Board of Engineers, created by Congress to aid in the construction of the Boulder Canyon dam project.

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GEORGE V. LONNECKER, chief engineer for the Iowa Public Service Company, Sioux City, Iowa, in the eastern division, with headquarters at Waterloo, has been made general superintendent of the eastern division. He will remain as chief engineer.

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E. W. FELLER, who has been connected with the operating department of the Pennsylvania Water & Power Company at Holtwood, has entered the operating department of the Safe Harbor Water Power Corporation, Safe Harbor, Pa.

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OBITUARY

ARTHUR H. LOWE, industrialist of Fitchburg, Mass., died October 27 in that city in his eightieth year. Mr. Lowe was prominently identified with the cotton industry for a number of years and held executive positions and served on the directorate of many corporations outside of that field. Some years ago he was president of the old Connecticut Water Power Company and at the time of his death he was a director of the New England Power Company.

New Equipment Available

Electrode Holder for Arc Welding

New type electrode holders for atomic-hydrogen arc welding with flexible tungsten electrodes have been announced by the General Electric Company. These flexible electrodes are carried in curved tubes, forming a part of the holder, and are brought into position through the means of a screw feed ejector.

The flexible tungsten electrode is made up of several small diameter tungsten wires which have been stranded together, and, as a result, the electrode is so flexible that the ends of a 12-in. length can be brought together without giving the electrode a definite set, it is claimed.

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SQUARE CASES DESIGNED to utilize a minimum of switchboard space feature the new H line of instruments announced by the Westinghouse Electric & Manufacturing Company. This new line includes ammeters, milliammeters, voltmeters, milli-voltmeters, single and polyphase power-factor meters, frequency meters and synchroscopes. Both a.c. and d.c. instruments are intended for service on large switchboards of steel, ebony asbestos or slate.

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GEAR REDUCTION UNIT built integral with the motor is announced by the Ideal Electric & Manufacturing Company, Mansfield, Ohio. No motor coupling is used as the high-speed gear is mounted directly upon the motor shaft. These units are available in all gear ratios from 2.09 to 1 up to 376 to 1, giving output speeds of from 86.1 r.p.m. to 4.7 r.p.m. using the standard 1,800-r.p.m. motor supplied with these units.

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RATCHET TYPE C-4-464 RELAY has been announced by Struthers Dunn, Inc., Philadelphia, Pa. The relay is placed near a push button. One push of the button and the contacts of the relay go shut, turning on a light, starting a fan, ringing a bell, turning on a heater, starting a motor, etc. Push the same button again and the energy goes off.

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SEPARATELY EXCITED COMPENSATED PLATING GENERATORS of a new design have been announced by the Columbia Electric Manufacturing Company, Cleveland, Ohio. It is claimed that the following advantages are obtained: The voltage may be set for any required drop, for a constant no load to full load voltage, or even for an increasing voltage on increasing load; moreover, this compensating effect is produced at all voltages within the operating limits of the machine—that is, the compensator circuit and the generator field circuit are separately adjustable and do not affect each other's proper functioning, etc.

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Low-Range Recording Milliammeter

A graphic milliammeter of the strip chart type having the exceedingly low range of 5 milliamperes for full scale is announced by the Esterline-Angus Company, Indianapolis. This instrument is direct-writing and contains no auxiliary amplifying equipment. The values are measured by a D'Arsonval measuring element of high accuracy, which has sufficient torque to operate the writing pen over a chart 4½ in. in width. The instrument will be of special interest to radio, sound and projection engineers as it provides a means of continuously recording the current in the plate circuit of a vacuum tube. These instruments are made in portable, wall and switchboard types and for chart speeds of from ¾ in. per hour to 1½ in. per second.

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DESIGNATED AS A PICK-UP REEL, a new tool which is mounted on the bed of a truck and driven by a chain and sprocket from an automotive winch is announced by the Utility Supply Company, Clintonville, Wis. It consists of a pair of standards or jacks in which an empty cable reel, capable of holding a mile of wire, is held.

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INDOOR FORM OIL CIRCUIT BREAKERS of the 5-kv., 3,000-amp., 50,000-kva., three-pole, non-oil throwing type are announced by the Delta-Star Electric Company, Chicago, Ill. The straight line motion mechanism, composed of non-magnetic steel parts, operates under heavy "Everdur" domed tank head, eliminating magnetic heating. The breaker lift rods travel through roller guides, insuring positive alignment with low friction losses and high speed of contact operation.

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A 30-AMP. AT 125 VOLTS OR 1-HP. DISK SWITCH which is a two-pole switch with one fuse, one blade and solid neutral has been announced by the Square D Company, Detroit, Mich. Front operation is obtained by the fact that the switch is not of the conventional knife-blade construction, but a small disk, rotating between two spring copper blades. This feature permits a small size cabinet and convenient operation, without the necessity of providing for blade swing or a side-operating handle.

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Slow-Acting Relay

A dashpot type, slow-acting relay designed for 110-volt, 60-cycle a.c. operation has been placed on the market by the Automatic Electric Company of Chicago. This is a delayed-action relay, the interval from the closing of the coil circuit to the operation of the spring contacts being adjustable from approximately one second to 1½ minutes. The relay coil is connected in series with a 2-mfd. condenser and draws a current of approximately ⅛ amp. The spring contacts can safely carry up to ½ amp. non-inductive load at voltages up to 50.

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ADDITION OF AN AIR CONDITIONER to round out its line of such equipment, including the oil burner recently announced, has been made by the General Electric Company. It is designed to operate in conjunction with the oil furnace for application to warm-air heating systems. Steam from the boiler is supplied to an extended heat transfer surface in the air conditioner, to supply heat to the circulated air. As the air is circulated it is filtered and properly humidified. The necessary pressure to force the air through the duct system is also supplied by the air conditioner. The air conditioner is built in a square, sectionalized, vertical cabinet, finished to harmonize with the oil furnace and basement furnishings.

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CAPACITOR TRANSFORMERS for correcting low power factor in existing luminous-tube sign installations are announced by the General Electric Company. The unit consists of a capacitor assembled with an air-cooled auto-transformer which steps up the supply voltage to a value permitting the most economical capacitor design. In direct-current districts, where rotary converters or dynamotors provide an a.c. supply for luminous tube signs, the use of capacitor transformers is recommended.

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LEONARD TRASH RACK RAKES which are simple in construction and in operation are announced by the S. Morgan Smith Company, York, Pa. Consisting of a series of teeth mounted in a tubular axle with wide heavy wheels on each end, the rake rolls down on the face of the trash rack, the teeth turning up to over-ride any obstacle. At the moment of the up-pull the teeth swing back into a horizontal position and rake the rack clean on the upward movement, carrying the trash up and dumping it automatically into the trash car or chute.